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Department of
Agriculture

**Forest
Service**

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Environmental Assessment

Bridge Thin Project

Chapters 1- 4 ----- Volume 1

McKenzie River Ranger District
Willamette National Forest
Lane County, Oregon

Legal Locations: Within T.15S, R.4E, T.15S, R.5E, T.16S, R.4E, T.16S, R.5E;

Willamette Meridian

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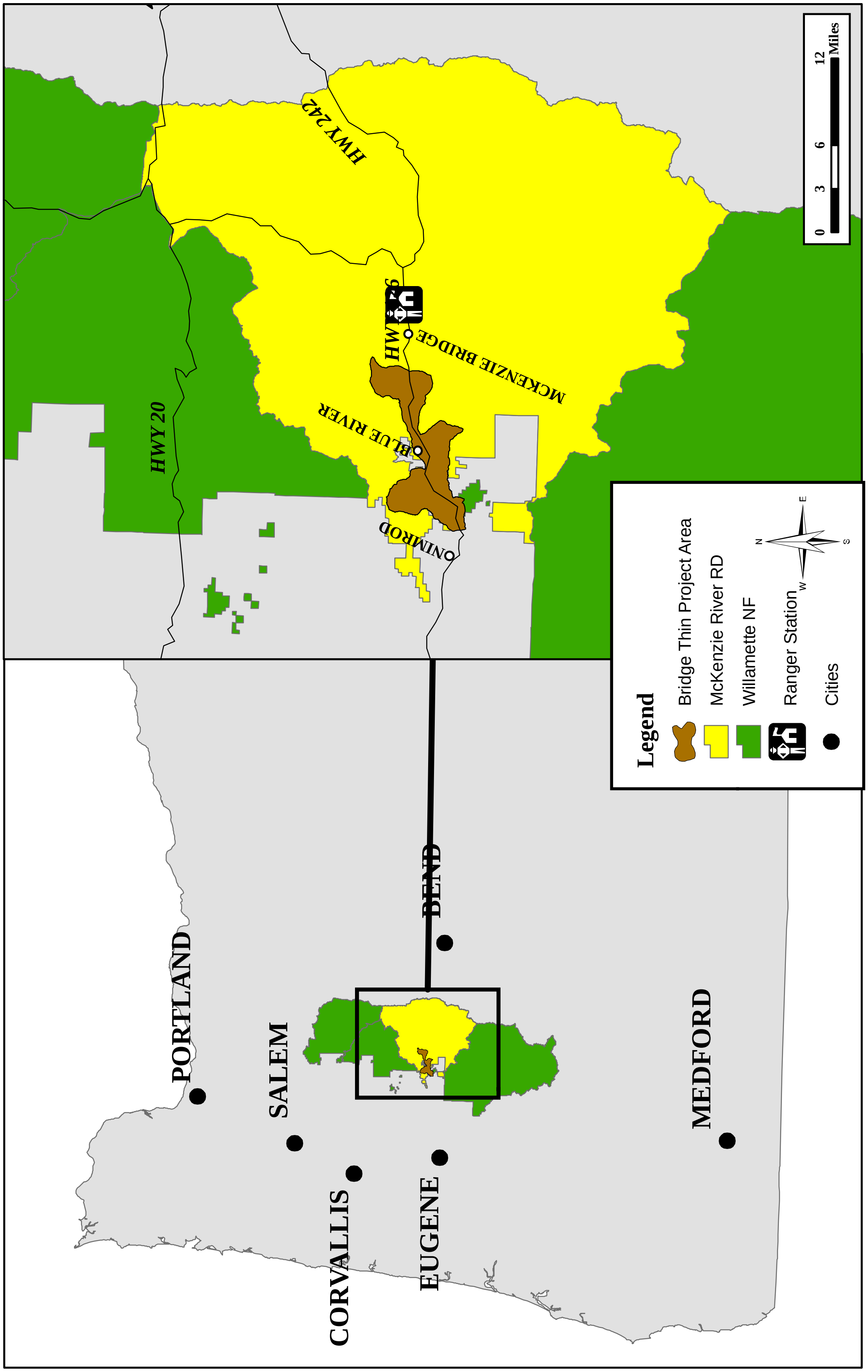

Figure 1. Bridge Thin Project location map.

Table of Acronyms:

ACS	Aquatic Conservation Strategy
ARP	Aggregate Recovery Percentage (hydrologic recovery)
BGEA	Big Game Emphasis Area
CWPP	Community Wildfire Protection Plan
dbh	Diameter breast height
DN/FONSI	Decision Notice/Finding of No Significant Impact
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
EWEB	Eugene Water And Electric Board
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FPC	Federal Power Commission
IDT	Inter-disciplinary Team
IRA	Inventoried Roadless Area
LFH	Listed Fish Habitat
MIS	Management Indicator Species
MRRD	McKenzie River Ranger District
MMBF	Million Board Feet
NEPA	National Environmental Policy Act
NFS	National Forest System
NMFS	National Marine Fisheries Service
ODOT	Oregon Department of Transportation
OSHA	Occupational Safety and Health Administration
ODFW	Oregon Department of Fish and Wildlife
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SEIS	Supplemental Environmental Impact Statement
SHPO	State Historic Preservation Office
SOPA	Schedule of Proposed Actions
TES	Threatened, Endangered, or Sensitive Species
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VQO	Visual Quality Objective
WA	Watershed Analysis
WFP	Willamette Forest Plan
WNF	Willamette National Forest
WUI	Wildland Urban Interface

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Chapter 1. Purpose and Need for Action

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters and appendices:

- **Chapter 1-Purpose and Need for Action:** This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. A section is included that details how the Forest Service informed the public of the proposal and how the public responded. This section also includes the relationship of the proposal to the 1990 Willamette Forest Plan, as amended.
- **Chapter 2 –Alternatives, Including the Proposed Action:** This section provides a more detailed description of the agency's proposed action as well as an alternative method for achieving the stated purpose. The alternative was developed based on significant issues raised by the public and other agencies. This discussion also includes a listing of mitigation measures and design features. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- **Chapter 3 -Environmental Consequences:** This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis discloses the effects on significant issues and the other issues addressed during scoping. Within each section, the affected environment is described first, followed by the effects from Alternative A – No Action, which provides a baseline for evaluation and comparison, Alternative B – Proposed Action, and Alternative C.
- **Chapter 4 - Consultation and Coordination:** This section provides a list of agencies, tribal governments, elected officials, and public consulted during the development of the environmental assessment. It also includes a list of IDT members who were involved in preparing this document.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including detailed analyses of project-area resources, may be found in the project planning record, or analysis file, located at the McKenzie River Ranger District Office in McKenzie Bridge, Oregon.

Introduction

The Bridge Thin Project area is within the McKenzie River / Elk Creek Subwatershed (6th field) of the McKenzie River/Quartz Creek Watershed (5th Field). The project area consists of 20,657 acres located between Finn Rock and McKenzie Bridge (See Figures 1 and 2).

Legal description of the project: Legal Locations: Within T.15S, R.4E, T.15S R.5E, T.16S, R.4E, T.16S, R.5E; Willamette Meridian; Lane County, Oregon.

Purpose and Need for Action

The purpose and need for this project is to improve stand conditions in terms of species composition, density, and structure over the long term in managed stands up to 80 years of age and fire regenerated stands generally up to 120 years of age. The amended Willamette Forest Plan includes goals and objectives for managing stands with silvicultural techniques to maintain stand health and vigor and provide multiple use benefits, moving the project area toward the desired condition.

Actions Are Needed To ➔
• Restore structural diversity in stem exclusion stands to enhance wildlife habitat;
• Accelerate restoration of late-successional conditions for stands within riparian reserves;
• Restore "open oak savannah" stands where they were historically present;
• Provide a sustainable supply of wood in support of the local and regional economy.
• Restore degraded roads infrastructure;
• Protect and maintain water quality and reduce hazardous fuel levels in the watershed for communities in the wildland-urban interface;
• Improve the role of fire as a natural disturbance process in the ecosystem.

Restore Structural Diversity in Stem Exclusion Stands to Enhance Wildlife Habitat

Overstocked, dense, stem exclusion stands are limited in providing quality wildlife habitat. A need exists to restore structural diversity through techniques such as variable density thinning with skips and gaps.

Accelerate Restoration of Late-Successional Conditions for Stands within Riparian Reserves

Dense, overstocked, stem exclusion stands in riparian reserves are limited in providing late successional conditions to allow connectivity between late successional reserves on the landscape. A need exists to restore late successional stand conditions through treatments, such as thinning, which can accelerate development of large trees and multi-storied stands.

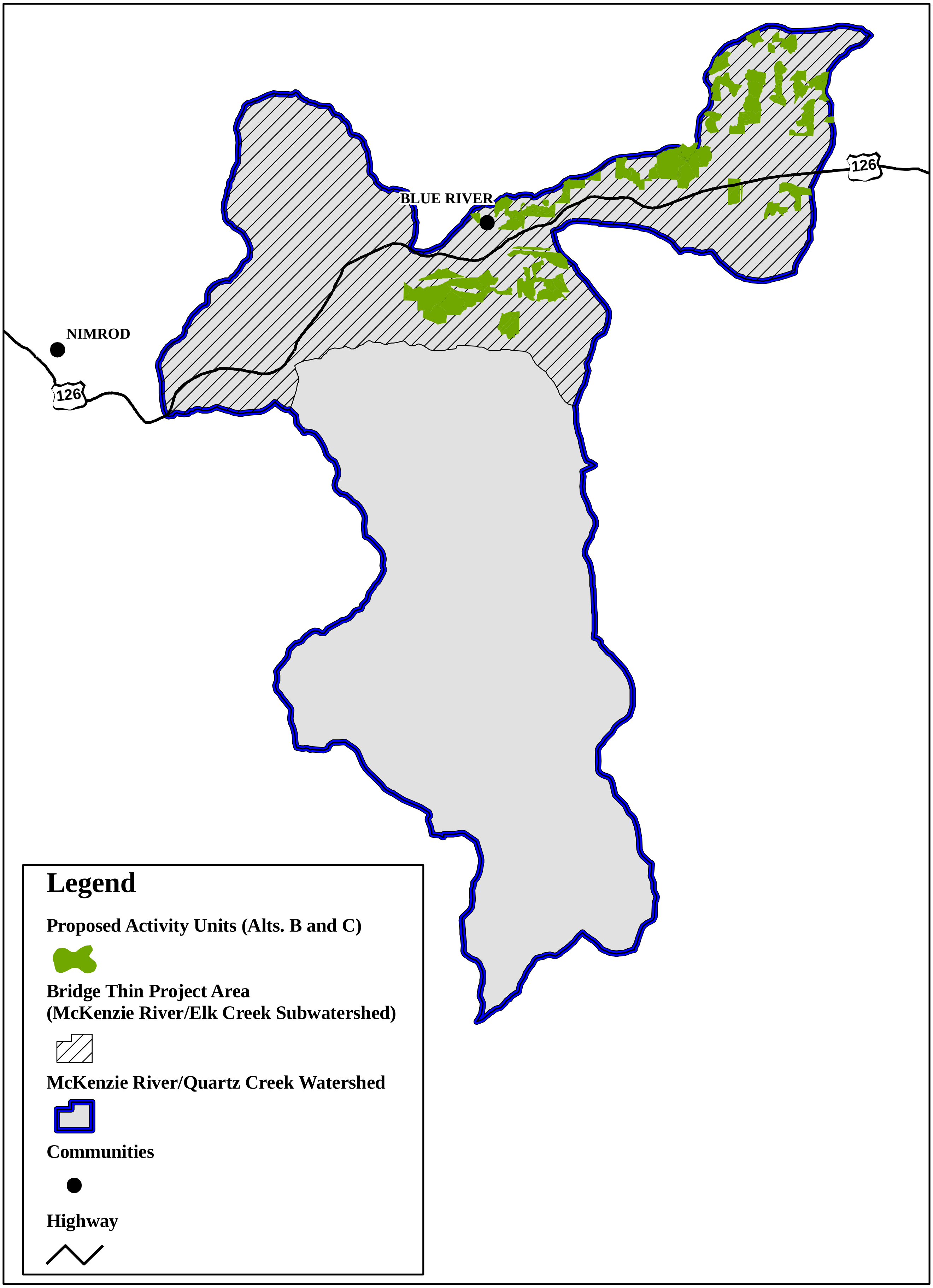


Figure 2. McKenzie River/Quartz Creek Watershed map.

Provide a Sustainable Supply of Wood In Support of the Local and Regional Economy.

This project is located predominately within the Adaptive Management Area allocation, as designated in the 1990 Willamette National Forest Land and Resource Management Plan, as amended (Willamette Forest Plan or Forest Plan) (USDA Forest Service. 1990). There is need to manage the project area to provide multiple-use benefits, as directed in the Willamette National Forest Land and Resource Management Plan, which includes an expected output of timber products at the optimum level to meet the long-term sustained-yield capacity. The Willamette Forest Plan describes the goal to meet timber outputs at IV-227, and sets forth Standards and Guidelines for harvest scheduling at FW-176 and 177.

The Northwest Forest Plan Final Supplemental Environmental Impact Statement (USDA Forest Service and USDI Bureau of Land Management. 1994), which led to the Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management. 1994a) amended the Willamette Forest Plan. It recognizes that “the need for forest products from forest ecosystems is the need for a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis” (page 1-4).

Restore “Open Oak Savannah” Stands Where They Were Historically Present

Remnant pockets of Oregon White Oak are scattered throughout the landscape. This unique habitat is being encroached upon by conifers. A need exists to restore this unique habitat by reducing conifer encroachment and restoring fire to the ecosystem.

Restore Degraded Roads Infrastructure

The forest roads in this planning area have a wide range of conditions and maintenance needs. The current road system was built to access timber and other forest resources. Timber sale revenues paid for the majority of past construction and road maintenance. However, timber harvest has declined under the Northwest Forest Plan. This change in forest management has seriously reduced the operating budget and the ability to maintain the road system. Maintenance of degraded roads in the project area is needed to access areas for management with minimum impact to other resources.

Protect and Maintain Water Quality and Reduce Hazardous Fuel Levels in the Watershed for Communities in the Wildland-Urban Interface

Reducing hazardous fuels decreases the potential severity of wildfires across the landscape, including stands adjacent to streams. The reduction of fuels levels is needed to protect life and property in the area, as well as to protect and maintain water quality. Bridge Thin Project Area treatments would reduce the hazardous fuels in streamside stands and the Wildland Urban Interface.

Improve the Role of Fire as a Natural Disturbance Process in the Ecosystem

Fire has and will continue to play an active and vital role in our forest ecology. Treatments in this project would help to return the ecological role of fire disturbance. Prior to European settlement, natural and human-induced fires helped create and maintain a diversity of ecosystems across the landscape. Over the past century Forest Service management has altered the natural disturbance process through fire suppression efforts. This change or lack of disturbance increases the probability of large high severity (high mortality) wild fires across the landscape. Improving the role of fire is needed to decrease the potential of large, high severity wildfires, and to move the ecosystem closer to the natural disturbance process.

Proposed Action

The Forest Supervisor on the McKenzie River Ranger District proposes to conduct activities on approximately 2,463 acres of the Bridge Project Area. The proposed activity acres include timber harvest (2,256), fuel treatments (193), and rock quarry/borrow pits use (14). The timber harvest would yield a gross estimate of 47.8 million board feet (MMBF) of wood products. This proposal, represented in Alternative B in this EA, would include heavy thinning on 1,368 acres, moderate thinning on 391 acres, oak savanna restoration on 30 acres, wildlife forage thinning on 190 acres, and riparian thinning on 145 acres. The timber sales from this proposal would likely be sold over a three year time span, beginning in fiscal year 2008.

The proposal also includes the activities listed below, which are described in detail in Chapter 2:

Proposed Action Activities
• **Yarding Systems:** Ground-based yarding systems would be used on approximately 770 acres, skyline yarding would occur on 960 acres, and helicopter yarding on 520 acres. Eight helicopter landings, each approximately 1/2 acre in size, would be located in the project area.
• **Open Oak Savanna Restoration:** Encroaching conifers would be harvested and the area underburned to maintain the open oak dominated hillside. The stands are remnant pockets of Oak Savanna which are being encroached upon by conifers. Shade resulting from the encroaching conifer species is hampering the regeneration of the Oregon White Oak (*Quercus qarryana*). The Oak Savanna habitat relies on fire to reduce competition from conifers and give the slower growing, more shade intolerant oak better opportunities to propagate. Oak savanna restoration would be anticipated to occur within 5 years after the project decision.
• **Post-harvest Planting:** In group selects created from root rot pockets, follow-up planting with species that are non-susceptible to the species of root disease may occur to augment natural regeneration. In random group selects stocking will be evaluated two years post harvest to evaluate needs. If a planting need is determined, underrepresented species will be planted to augment natural regeneration.
• **Subsoiling:** Soil would be ripped to promote regeneration and provide a suitable environment for future growth. Subsoiling is used to offset compaction from equipment where the harvest prescription resulted in little to no residual stand and no further silvicultural treatments will be necessary for 40 or more years. Group selects and/or the Oak Savannah will potentially have subsoiling needs if ground based operations create compaction within the unit or landings.

- **Road Closures and Decommissioning**: Activities are proposed to close Forest roads in the project area to reduce erosion and improve wildlife habitat. The proposed action would close a total of 0.2 miles of currently open road, by placement of an earthen berm. Decommissioning (the obliteration of an existing system road) is planned for 0.3 miles of currently closed roads.
- **Road Maintenance:** Forest roads used for timber haul that do not currently meet Forest standards for safety and haul suitability would receive road maintenance prior to use. Appropriate road maintenance would be performed on approximately 34 miles of Forest roads during operations and upon completion of sale activities. Part of the road maintenance activities would be the replacement of 42 culverts in the project area. This would include the replacement of the culvert at the Mill Creek crossing on road 2633-720 would be improved to pass 100-year flows, also allowing passage for aquatic wildlife species. Proposed Road maintenance activities would occur within 5 years of the project decision.
- **Temporary Road Construction:** The proposed action requires the connected action of constructing 25,500’ of temporary roads to access proposed timber harvest units in the Bridge Thin Project area. Temporary roads would be decommissioned after the logging operations are completed. The construction and decommissioning of temporary roads in the project would occur within 5 years of the project decision.
- **Rock Quarry Development:** The proposed action requires the connected action of expanding an existing Rock Quarry. The Mill Creek Rock Quarry is located on Forest Road 2633-720. The development of the Rock Quarry is needed to supply crushed rock and riprap for maintaining roads accessing the Bridge Thin Project area. It is estimated that less than 15,000 cubic yards of crushed rock and riprap would be needed. Blasting would be part of the rock pit expansion. Resulting noise impacts on wildlife are considered in the analysis. Expansion of the existing Mill Creek Quarry would be conducted within 5 years of the project decision.
- **Wildland Urban Interface (WUI) Fuels Thins/Natural Fuels Underburn:** WUI fuel thins would take place on approximately 142 acres (Units 50, 89, 95-99, 101-103). The thinning treatment would target trees and shrubs <7” DBH, and fuels created would be piled and burned or chipped/mulched where feasible. Natural fuels underburns would take place to reintroduce the natural disturbance of fire on approximately 51 acres in units 86, 87, and 100 and reduce ladder fuels that contribute to potentially severe wildfire. Vegetation would not be harvested or mechanically altered in stands subject to natural fuels underburn; only fire would be applied to change the horizontal and vertical arrangement of fuels. Units 86 and 87 would only be underburned if surrounding units are also treated. The proposed fuels treatments would occur within 5 years of the project decision.
- **Logging Slash Fuels Treatment:** Slash would be treated with underburning or burning landing piles, hand piles, and machine piles after harvest. These treatments would reduce the slash fuels created by timber harvesting and reintroduce the disturbance process of fire to the landscape within the harvest units. Logging systems design would help to reduce concentrations of slash in units that cannot be underburned without unacceptable impacts to the residual stand. Slash fuels may be pre-bunched in units where ground and skyline operations occur. The logging slash fuel treatments would occur within 5 years of the project decision.

Non-Significant Forest Plan Amendment #50

This non-significant amendment includes a one-time exemption of Management Area Standard and Guideline MA-5a-01.

MA-5a-01: An Implementation Guide shall be prepared for each SIA (Special Interest Area) describing the site specific management objectives, enhancement programs, and other acceptable uses and activities.

An Implementation Guide has not been completed for the MA-5a land allocation (McKenzie River SIA) within the project area. However, all action alternatives were developed while considering site specific management objectives, enhancement programs, and other acceptable uses and activities within this management area. These criteria would be incorporated into the Implementation Guide that would be subsequently prepared for the project area to guide future management.

No commercial timber harvest would occur within the McKenzie River SIA. Activities within the McKenzie River SIA are focused on fuel reduction to decrease the potential for high intensity wildfires in the Wildland Urban Interface (WUI).

Decision Framework

The Responsible Official for this proposal is the Willamette National Forest Supervisor. Given the purpose and need stated above, the Responsible Official reviews the proposed action and the other alternative actions in order to make the following determinations:

- The proposed actions as analyzed, comply with the applicable standards and guidelines found in the Willamette Forest Plan and all laws governing Forest Service actions.
- Sufficient site-specific environmental analysis has been completed.
- The proposed actions benefit the public and are in their best interest.

With these assurances the Responsible Official must decide:

- Whether or not to select the Proposed Action or one of the alternatives, which includes the No-Action Alternative; and what, if any, additional actions should be required.
- Whether the selected alternative is consistent with the Willamette Forest Plan, or if the Forest Plan shall be amended in this action.

Tiering and Incorporating by Reference

In order to eliminate repetition and focus on site-specific analysis, this EA is tiered to the following documents as permitted by 40 CFR 1502.20:

- The Willamette National Forest Land and Resource Management Plan (Forest Plan) FEIS and Record of Decision (ROD) dated July 31, 1990, and all subsequent NEPA analysis for amendments, including the April 1994, Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Spotted Owl, or Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management. 1994a), and the accompanying Land and Resource Management Plan, as amended. The Forest Plan guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management.

- This EA also tiers to a recent broader scale analysis for invasive plants (the Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, hereby referred to as the R6 2005 FEIS) (USDA Forest Service. 2005). The R6 2005 FEIS culminated in a Record of Decision (R6 2005 ROD) that amended the Willamette National Forest Plan by adding management direction relative to invasive plants. This project is intended to comply with the new management direction. Proposed actions would also incorporate measures contained in the December 1988, Record of Decision and FEIS for Managing Competing and Unwanted Vegetation, and the requirements of the Mediated Agreement, signed May 24, 1989 by USFS, NCAP, OFS, et al.

The Forest Plan

The Willamette Forest Plan, as amended, provides resource management goals and gives direction to apply a range of harvest methods to timber stands. Chapters II and III from the FEIS discuss silvicultural activities expected to occur on suitable lands on the Forest. Appendix F from the FEIS further documents the rationale used to determine the appropriate harvest systems to be used in managing coniferous forests on the Willamette National Forest where timber production is a management goal.

Table 1 displays Management Area acres as designated in the amended Willamette Forest Plan (WFP) for the project area. The table also includes the overlying land allocations from the 1994 Northwest Forest Plan. Five of the six Northwest Forest Plan (NWFP) allocations are present and consist of Adaptive Management Area, Administratively Withdrawn, Late-Successional Reserves, Matrix, and Riparian Reserves. However, because Riparian Reserves overlap with other land allocations, they are not represented in the table. The intent is to accurately display WFP Management Area acres. Riparian Reserves within harvest units are displayed in Chapter 3, in the Water Quality/Aquatic Resources section. Management areas corresponding to both the WFP and the NWFP within the Bridge Thin project area are displayed in Figures 3 and 4. All proposed activity units are located in the Adaptive Management Area NWFP land allocation.

Table 1. Management Areas within the Project Area*.

Willamette Forest Plan Management Areas	Northwest Forest Plan Land Allocations	Total Acres	Acres in Activity Units
5a – Special Interest Areas	*Administratively Withdrawn*	17	0

Willamette Forest Plan Management Areas	Northwest Forest Plan Land Allocations	Total Acres	Acres in Activity Units
5a – Special Interest Areas	*Adaptive Management Area*	925	71
7 – Old Growth Groves	*Adaptive Management Area*	113	0
9c – Wildlife Habitat-Marten	*Administratively Withdrawn*	43	0
9c – Wildlife Habitat-Marten	*Adaptive Management Area*	56	0
9d – Wildlife Habitat-Special Areas	*Adaptive Management Area*	769	295
11a – Scenic-Modification Middleground	*Late Successional Reserves*	139	0
11a – Scenic-Modification Middleground	*Adaptive Management Area*	1,188	480
11c – Scenic-Partial Retention Middleground	*Matrix*	29	0
11c – Scenic-Partial Retention Middleground	*Late Successional Reserves*	694	0
11c – Scenic-Partial Retention Middleground	*Adaptive Management Area*	2,975	1,085
11e – Scenic-Retention Middleground	*Late Successional Reserves*	183	0
11e – Scenic-Retention Middleground	*Adaptive Management Area*	805	348
11f – Scenic- Retention Foreground	*Adaptive Management Area*	1,015	184
14a – General Forest	*Matrix*	9	0
16a – Late Successional Reserves	*Late Successional Reserves*	2,944	0
16b – 100-acre Late Successional Reserves	*Late Successional Reserves*	39	0
17– Adaptive Management Area	*Adaptive Management Area*	118	0
Non-USFS Lands		8,696	0
Total Acres		**20,657**	**2,463**

The following briefly discusses the goals of the Forest Plan Management Areas where harvest units or other management actions are included in action alternatives. See Chapter 2, Tables 2, and 4, for prescriptions by alternative.

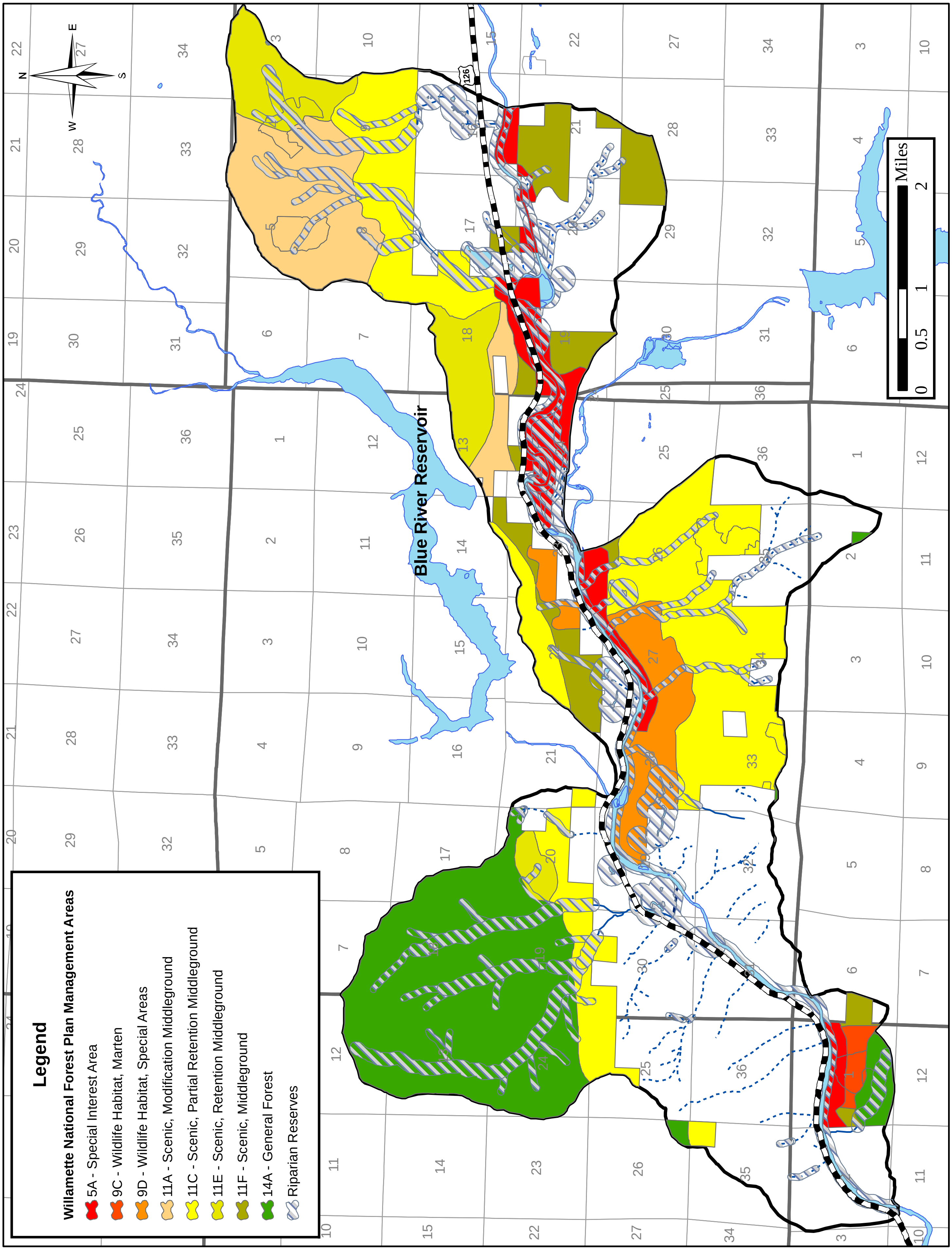


Figure 3. Willamette National Forest Plan Management Areas in the Bridge Thin Project Area.

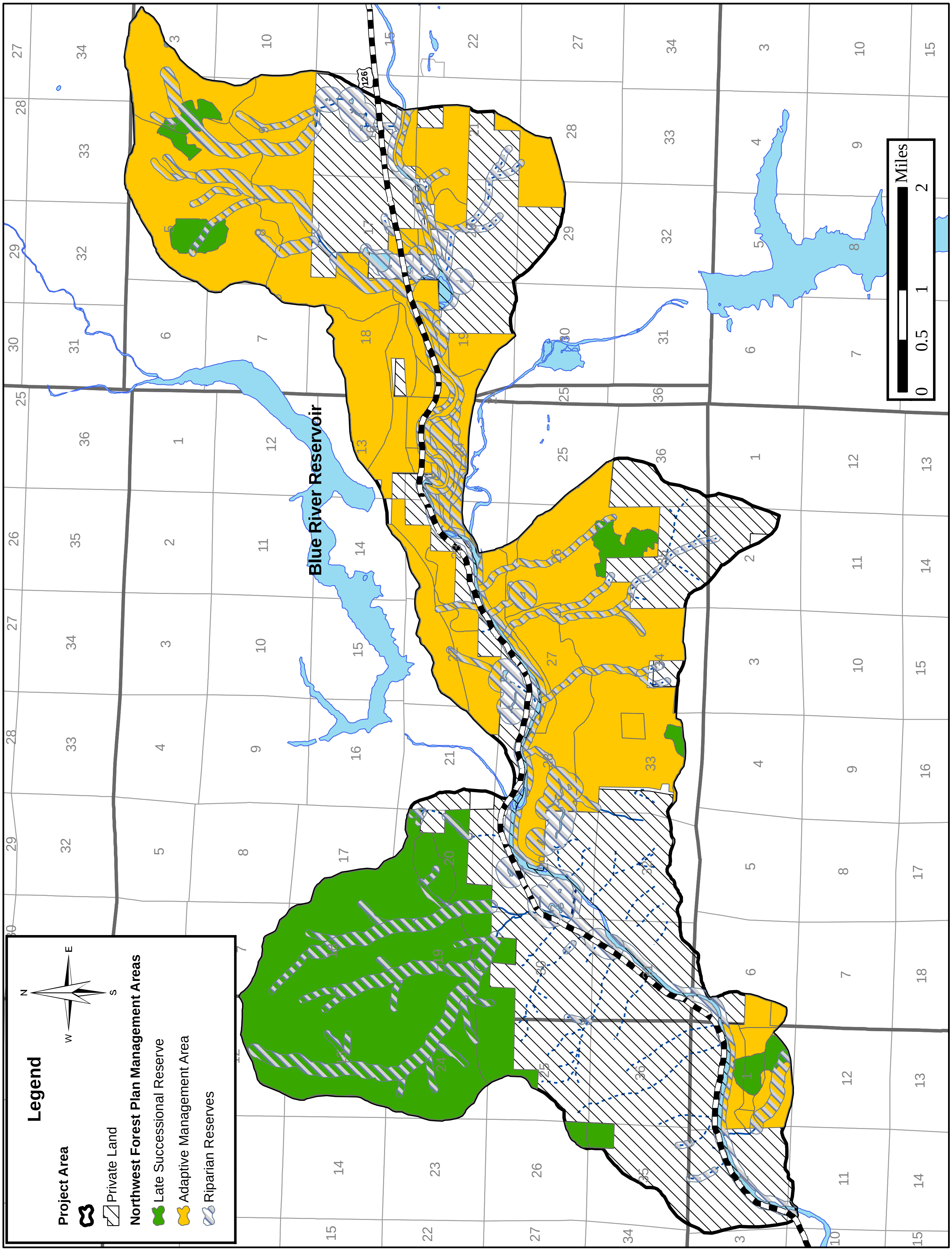


Figure 4. Northwest Forest Plan Management Areas in the Bridge Thin Project Area.

MA-5a, Special Interest Area –McKenzie River

Activity units partially or entirely within MA-5a: *95, 97, 98, 100, 102, and 103.*

The goals of these management areas are to: 1) Preserve lands that contain exceptional scenic, cultural, biological, geological, or other unusual characteristics, and 2) Foster public use and enjoyment in selected special interest areas through facility development. No programmed timber harvest shall be scheduled. Cutting and removal of vegetation shall be prohibited except to provide for the safety of users or to maintain or the values of the area.

No commercial timber harvest would occur within MA-5a. Activities within this area would be focused on fuel reduction to decrease the potential for high intensity wildfires in the Wildland Urban Interface (WUI).

MA-9d, Wildlife Habitat – Special Areas

Activity units partially or entirely within MA-9d: *1, 3, 6, 7, 8, 10, 21, 84, 85, 86, 88, and 841.*

The goal of these management areas is to protect or enhance unique wildlife habitats and botanical sites that are important components of healthy, biologically diverse ecosystems. No programmed timber harvest shall be scheduled. Vegetative treatments, including commercial harvests, should be permitted if necessary to meet established wildlife objectives. Sustained timber production is not a Management Area objective.

Timber harvest units 84, 85, and 86 are in a unique oak savannah area. An objective of this area is to protect and enhance this unique habitat.

MA-11a, Scenic, Modification Middleground

Activity units partially or entirely within MA-11a: *26,29, 30,32, 35, 41,42, 43, 44, 45, 46, 47, 48, 52, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, and 70.*

The goal of this management area is to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a modest level of scenic quality. This area would also be managed for other resource goals including timber production, recreational opportunities, watershed protection, and maintenance of wildlife habitat. The maximum area in a disturbed condition should not exceed 24% of the acres available and suited for timber harvest in this management area.

This allocation is primarily located along the mid-slopes of the McKenzie River valley in the Bridge Thin Project area. It consists of the middleground viewshed along the north side of State Highway 126. State Highway 126 is a major state transportation route and is included in the McKenzie-Santiam Pass National Scenic Byway system.

MA-11c, Scenic, Partial Retention Middleground

Activity units partially or entirely within MA-11c: *1, 2, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 27, 28, 35, 36, 37, 38, 39, 40, 41, 44, 49, 50, 51, 54, 55, 56, 58, 59,67, 68,69, 70, 71, 72, 80, 81, 82, 83, 84, 89, and 91.*

The goals for this visually sensitive management area are to maintain a moderate level of scenic quality, and also to manage for other resource goals including wildlife habitat, recreation, watershed, and timber production. The maximum area in a disturbed condition should not exceed 20% of the acres available and suited for timber harvest in this management area.

This allocation is primarily located along the mid-slopes of the McKenzie River valley in the Bridge Thin Project area. It consists of the middleground viewshed along both sides of State Highway 126 and below Blue River Reservoir.

MA-11e, Scenic, Retention Middleground

Activity units partially or entirely within MA-11e: *29, 30, 31, 32, 33, 34, 35, 36, 37, 56, 57, 58, 59, 60, and 69.*

The goal of this management area is to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a high level of scenic quality. This area would also be managed for other resource goals including maintenance of wildlife habitat, recreational opportunities, watershed protection, and timber production. The maximum area in a disturbed condition should not exceed 14% of the acres available and suited for timber harvest in this management area.

This allocation is primarily located along the mid-slopes of the McKenzie River valley in the Bridge Thin Project area. It consists of the middleground viewshed along the north side of State Highway 126.

MA-11f, Scenic, Retention Foreground

Activity units partially or entirely within MA-11f: *27, 28, 80, 81, 82, 83, 84, 87, 88, 89, 91, 95, 96, 97,98, 99, 100, 101, 102, 103*

The goal of this management area is to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a high visual quality. This area would also be managed for other resource goals including maintenance of wildlife habitat, recreational opportunities, watershed protection, and timber production. The maximum area in a disturbed condition should not exceed 10% of the acres available and suited for timber harvest in this management area.

This allocation is primarily located along the mid-slopes of the McKenzie River valley in the Bridge Thin Project area. It consists of the middleground viewshed along the north side of State Highway 126.

MA-15, Riparian Reserves

Timber harvest units which include riparian reserves are listed in Chapter 2, Table 2.

Riparian Reserves are one of the six designated management areas identified in the Northwest Forest Plan. The primary goal for lands located in this management area is to maintain the ecological function of rivers, streams, wetlands, and lakes within the landscape.

Riparian Reserves include at least the water body, inner gorges, all riparian vegetation, 100-year floodplain, landslides, and landslide-prone areas. Reserve widths are based on either a multiple of the site-potential tree or a prescribed slope distance, whichever is greater. Reserve widths may be adjusted based on watershed analysis to meet Aquatic Conservation Strategy (ACS) objectives. The

ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands by maintaining and restoring ecosystem health at watershed and landscape scales. The intent is to protect habitat for fish and other riparian-dependent species and to restore currently degraded habitats.

All action alternatives have management activities that occur in Riparian Reserves, such as thinning, activity fuels treatments, natural fuels prescribed underburning, and road restoration projects are designed to be consistent with ACS objectives.

Public Involvement

Scoping is the process for determining issues relating to a proposed action and includes review of written comments, distribution of information about the project, interdisciplinary Team (IDT) meetings, and local news releases.

Scoping began on the Bridge Thin Project under the current proposed action on May 18, 2007. The McKenzie River Ranger District sent a public scoping letter with preliminary information about this EA to a project mailing list of 54 interested individuals, agencies, tribal governments, and elected representatives. The scoping letter described the proposed action, a purpose and need for action, a summary of the proposed action, a brief summary of preliminary issues, and alternatives actions. The Bridge Thin Project has been listed in the Forest Focus – the quarterly schedule of proposed actions (SOPA) for the Willamette National Forest, since December 11, 2006

Issues

Issues are points of concern about environmental effects that may occur as a result of implementing the proposed action. They are generated by the public, other agencies, organizations, and Forest Service resource specialists and are in response to the proposed action.

Significant issues describe a dispute or present an unresolved conflict associated with potential environmental effects of the proposed action. Significant issues are used to formulate alternatives, prescribe mitigation measures, and focus the analysis of environmental effects. Significant issues are also determined based on the potential extent of their geographic distribution, duration of their effects, or intensity of interest or resource conflict, if not mitigated or otherwise addressed. The significant issues for this project were identified by the ID Team and approved by the Responsible Official.

Significant issues are tracked through Issue Identification (Chapter 1), Alternative Development and Description (Chapter 2), and Environmental Consequences (Chapter 3). Measurement criteria have been identified for the significant issues and are used to compare alternatives. These criteria are shown in comparison in Table 11 at the end of Chapter 2.

In addition to the significant issues, other issues or non-significant issues were raised by the public or Forest Service resource specialists. These issues were determined to be non-significant because they were; 1) outside the scope of the proposed action, 2) already decided by law or regulation, Forest Plan, or other higher level decision, 3) irrelevant to the decision to be made, or 4) conjectural and not supported by scientific or factual evidence. These issues are less focused on the elements of the purpose and need for action and did not influence the formulation of alternatives. Several of the non-significant issues are also included in the environmental effects analysis (Chapter 3) because of regulatory or policy direction.

Significant Issues

Issue 1. Water Quality/Aquatic Resources

Past management activities have resulted in impacts to the riparian and aquatic resources of the analysis area. Proposed management activities such as timber harvest, prescribed fire, and road construction can adversely affect water quality, and aquatic and riparian habitat. The most common impacts include: reduction of large wood available for input to streams, removal of shading vegetation, and increases in sedimentation. These effects can result in simplification or elimination of fish and other aquatic habitat, and degradation of water quality with respect to elevated stream temperatures and increases in sediment delivered to streams. However, these same proposed management activities can positively affect these resources by creating stand conditions that favor the development of future large wood and other late-successional stand characteristics, as well as providing opportunities to restore degraded conditions that are the result of past activities in the watershed.

Beneficial uses that are dependent on the quality of the water in the McKenzie River in the project area include spawning and early rearing habitat for spring Chinook salmon, rearing and foraging habitat for sub-adult and adult bull trout (both listed as Threatened species and protected under the Endangered Species Act), and use as public drinking water for the City of Eugene at the Hayden Bridge intake downstream of the project area. Tributaries to the McKenzie River in the project area provide habitat for additional aquatic organisms, including cutthroat and rainbow trout, mountain whitefish, and brook lamprey, considered Management Indicator Species in evaluating project effects to animals and their habitat.

The effects of this project on water quality and aquatic and riparian habitat are evaluated by the following criteria:

Issue #1 Water Quality/Aquatics—Indicators
• **Indicator #1:** *Changes in available stream shade and potential to increase stream water temperatures.* **Measurement:** Projected increase in stream water temperature above current condition (Degrees Celsius) • **Indicator #2:** *Changes in risk of altered peak flows.* **Measurement:** Expressed by the Aggregate Recovery Percentage (ARP) • **Indicator#3:** *Estimated project effect on short-and-long term transport of sediment from project area roads.* **Measurement:** Cubic yards of sediment yield originating from roads during and after the project.

- **Indicator #4:** *The amount of riparian area receiving treatment, and the effects of the treatment on riparian stand composition.*
  Measurement: Acres and % of riparian thinned

Issue 2. Threatened Northern Spotted Owl

The northern spotted owl, a Threatened species in terms of the Endangered Species Act (ESA), has specific requirements under the ESA with regard to protection of habitat. Protection includes consultation or conferencing with the US Fish and Wildlife Service (USFWS) on activities that alter habitat or cause disturbance. Northern spotted owl habitat can be classified as **Suitable** (nesting, roosting, foraging) or **Dispersal** habitat. It is important to note that part of the Bridge Thin project area is located with a northern spotted owl Critical Habitat Unit (CHU). Management activities may change the quality or quantity of current and future northern spotted owl habitat.

The effects of the alternatives on threatened northern spotted owl are evaluated by the following criteria:

Issue #2 Northern Spotted Owl—Indicators

- **Indicator #1:** *The amount of suitable northern spotted owl habitat downgraded or removed from a Critical Habitat Unit.*
  Measurement: Acres of suitable northern spotted owl habitat downgraded or removed from a Critical Habitat Unit.

- **Indicator #2:** *The amount of dispersal northern spotted owl habitat removed from a Critical Habitat Unit.*
  Measurement: Acres of dispersal northern spotted owl critical habitat removed from a Critical Habitat Unit.

Non-Significant Issues and Concerns

These *other issues* were addressed in project development. The issue statements below are followed by reasons why they were not considered significant to the development of alternatives and not always fully analyzed in the following chapters. However, they may serve as important tools that are used to qualitatively evaluate differences between alternatives.

Soil Productivity/Slope Stability

Soil compaction and displacement can occur during timber harvest and road construction activities, which could adversely affect the re-establishment of vegetation and the hydrologic capacity of the soils. Road construction and timber harvest can reduce slope stability on potentially unstable slopes.

Since the potential effects identified with this issue would be effectively mitigated by measures designed to comply with the Willamette Forest Plan, this issue was not considered significant for designing alternatives to meet the purpose and need for action. All action alternatives meet or exceed standards and guidelines for soil protection from the Willamette Forest Plan, through incorporation of Best Management Practices for the protection of soil resources.

Variable Density Thinning

Scoping comments were received that urge the use of variable density thinning in the managed stands for this proposal. Variable density thinning would begin development of late-seral stand characteristics over time.

This issue was not considered significant because silviculture prescriptions and marking guidelines include variations in average residual tree spacing of between 17 and 35 feet. The average spacing along with holes caused by natural disturbances like insects and diseases, and windthrow along with untreated reserves will result in a stand with variability in continuity and density, similar to the that suggested by the commenters (see Silvicultural Descriptions, Moderate Commercial Thinning). Commercial thinning prescriptions would result in much the same variation in stand density after treatment as suggested by the commenters. (see Silvicultural Descriptions, Moderate Commercial Thinning, page 69)

Sensitive or Other Terrestrial Species of Concern

Activities that remove or degrade forest habitats might affect a variety of wildlife and botanical species. Activities that create noise above ambient levels may also impact a variety of wildlife species.

This issue was not considered significant because all actions that remove or degrade forest habitat would be required to follow conservation and protection guidelines provided by the Willamette Forest Plan to avoid adverse affects on listed species. Activities that generate noise above ambient levels near nest sites of Sensitive or other wildlife species of concern would be seasonally restricted. Activities that generate noise above ambient levels near nest sites of Sensitive or other wildlife species of concern would be seasonally restricted. Design measures and mitigation measures address this issue in Chapter 2. The effects of the proposed action and the other alternatives on Sensitive and other wildlife species of concern are addressed in Chapter 3.

Migratory Land Birds

This project could affect Neotropical Migratory Birds and their habitat, which varies broadly for this large group of species. Required-protection for these species is outlined in the Migratory Bird Treaty Act.

This issue was not considered significant because the proposed silvicultural treatments promote understory shrub development, tree species diversity, deciduous trees, and the growth of larger trees. As a result, snags and downed logs are maintained and created, as well as the creation of gaps, which generally improve avian biodiversity in the stand. The effects of the proposed action and other alternatives on migratory land birds are addressed in Chapter 3.

Big Game Habitat

Big game Emphasis Areas (BGEAs) are those managed for Habitat Effectiveness under guidance from Willamette National Forest Plan. There are three Emphasis Areas within the Bridge Thin project area.

Proposed actions could alter big game habitat by changing the amounts of foraging, hiding and thermal cover habitat as well as open road densities.

This issue was not considered significant because project action alternatives meet applicable Standards and Guidelines from the Willamette Forest Plan for the management of Big game Emphasis Areas. The effects of the action alternatives on big game habitat are addressed in Chapter 3.

Management Indicator Species (MIS)

Proposed actions could affect Management Indicator Species located within the project area as listed and described in the Willamette Forest Plan. The Forest MIS species list includes the northern spotted owl, pileated woodpecker, marten, elk, deer, cavity excavators, bald eagle, peregrine falcon, sea-run spring Chinook salmon, river-dwelling bull trout, and resident fish species like rainbow trout, cutthroat trout, mountain whitefish, and brook lamprey. Through Region-wide coordination each Forest identified the minimum habitat distribution and habitat characteristics needed to satisfy the life history needs of MIS. Management recommendations to ensure the viability of Management Indicator Species were incorporated into all action alternatives analyzed in the 1990 Willamette Forest Plan FEIS.

This issue was not considered significant because action alternatives from this project meet applicable Standards and Guidelines from the Willamette Forest Plan, and are designed to protect these species. The effects of the proposed action and other alternatives on MIS are addressed in Chapter 3.

Fire and Fuels

Proposed actions may increase or reduce the severity of the effects from wildfires that could occur within the project area. Reducing biomass through thinning with mitigation of increased ground fuel loading, due to harvest activities, changes the fire spread characteristic of the stand to reduce fire spread rate and intensity of burning. Leaving activity created slash untreated would increase fire spread and intensity. Prescribed fire treatments intend to reduce activity fuels or naturally occurring fuels and could lessen the impact and severity of future wildfires in the project area by reducing the continuity of fuels across the landscape. The methods of fuel treatments, the time of year prescribed fire is applied, and the frequency of prescribed fire treatments can change and reduce the amount and the arrangement of fuel over the landscape. Air quality may also be affected during prescribed burning, given the close proximity of the Class I Airsheds (Mt. Washington and Three Sisters Wilderness) and the Designated Area of Willamette Valley (Leaburg).

The Bridge Thin Project Area is adjacent to private land along the McKenzie River, including the town of Blue River, the development of Rainbow, and several groups of homes and structures. These areas are located in the Wildland Urban Interface (WUI), and would also be a part of the Lane County Community Wildfire Protection Plan (CWPP). This CWPP was developed in 2005 by the Oregon Natural Hazards Resource Committee and adopted by Lane County. The implementation of this plan has not begun in all communities in Lane County. However many Bridge Thin treatments occur within the WUI, as identified in the Lane County CWPP, and are discussed.

This issue was not considered significant because design measures and accepted procedures for fuels treatments and air quality standards would follow the Willamette Forest Plan Standards and Guidelines (See Chapter 3 – Fire and Fuels analysis.)

Global Climate Change

Forests are considered sinks for carbon and studies suggest the potential for large wildfires to be detrimental to global climate (JFSP, 2007). The scale of analysis for climate change, however, is large and many potential causal factors are still being researched and evaluated. The reduction of hazardous fuels to help reduce the severity or size of wildfires – especially in and adjacent to WUI – would aid in safe fire suppression efforts when helping to protect forested areas. The reduction of hazardous fuels and the reintroduction of fire help reduce the severity or size of future wildfires which could aid in reducing the combustion of sequestered carbon in trees. An indirect effect may be reduced CO^2 emissions than would occur in a wildfire and as a result, more carbon would be retained on site. Because of the large scale aspects of climate change and the limited scope and scale of the proposed action, however, this issue is not considered significant in the context of the decision to be made.

Invasive Plants

Proposed actions may introduce or spread noxious and non-native invasive plants. Off road vehicle and equipment use, ground disturbance, and created openings in the forest canopy resulting from any action alternative, can provide an opportunity for noxious and non-native plants to establish and out-compete the desirable native vegetation.

Among the 16 documented Invasive Plants in the watershed, 8 are “new invaders” (weeds limited in distribution with the possibility of eradication based on knowledge of their location). Many of these weeds are capable of broad ecological tolerance, prolific growth, and abundant seed production. Spotted knapweed (*Centaurea maculosa*) and false brome (*Brachypodium sylvaticum*) spread primarily by vehicular traffic and have quickly become established along forest roads found in the project area. Other species such as English Ivy (*Hedra helix*) and field bindweed (*Convolvulus arvensis*) are more effective utilizing animal vectors and rhizomes (underground root stems) to aid in propagation.

This issue was not considered significant because prevention measures, such as washing of equipment, re-vegetation using local native species, and minimizing creation of open, disturbed areas adjacent to existing weeds would be used for all action alternatives. These measures would prevent population expansion and to minimize establishment of new invaders. (See Mitigation Measures and Design Measures detailed in Chapter 2.)

Roads and Access

Management decisions could increase or decrease the roaded condition of the landscape, potentially affecting slope stability, water quality, and recreational access. Many of the roads within the project area are below current maintenance standards and are not drivable. This project would provide opportunities to improve current conditions on the 34 miles of road needed for rock and timber haul.

Existing roads that pose potential adverse affects to riparian resources would require improvements to comply with existing Best Management Practices.

This issue was not considered significant because all action alternatives perform maintenance on roads where the need is identified. The affects of the proposed action and other alternatives on roads and access are discussed in Chapter 3.

Recreation

Timber harvest and associated activities within and adjacent to proposed harvest units could affect both dispersed and developed recreation activities. Mitigation measures listed in Chapter 2 would restrict loaded helicopter flights so they do not fly over specific areas during harvest to ensure public safety. The proposed action is designed to be consistent with all Willamette Forest Plan standards and guidelines. The fuels reduction treatment proposed for unit 100 may impact hikers on the King-Castle trail with noise and associated smoke from burning activities.

This issue was not considered significant because the number of affected recreasionist woud be small, the impacts would be short-term, and mitigation measures would provide for public safety. The proposed action is also designed to be consistent with Willamette Forest Plan standards and guidelines for recreation management. Effects of the proposed action and other alternatives on recreation are discussed in Chapter 3.

Scenic Quality

Proposed actions include timber harvest that may affect visual management allocations in the planning area by creating openings from timber harvest, affecting visual quality. The view shed of the project area contains management allocations (MA-5a, 9d, 11a, 11c, 11e and 11f). Refer to information chart in Chapter 1 for specific unit numbers within each Management Allocation.

Harvesting activities may be viewed from Highway 126 and the McKenzie River.

Fuels reduction activities within unit 100 may be viewed along the King-Castle Trail. Commercial thinning harvest may also alter form and texture, affecting visual quality. This issue was not considered significant because the proposed action is designed to be consistent with Willamette Forest Plan visual quality standards and guidelines. Effects of the proposed action and other alternative on scenic quality are discussed in Chapter 3.

Roadless and Unroaded Areas

Comments were received during scoping from Oregon Wild that expressed concerns about timber harvesting within “roadless areas” defined by Oregon Wild, and “uninventoried unroaded areas” defined by the Willamette Roads Analysis. The specific concern was that logging in these areas has the potential to disturb soil and water, destroy scenic integrity, eliminate reference landscapes, limit primitive recreation, introduce non-native weeds, and disturb cultural resources.

A portion of the Mt. Hagen Inventoried Roadless Area (IRA) occurs within the Project Area, but no proposed activities are planned within two miles of the IRA. The proposed action includes harvest units within uninventoried, unroaded areas. However, this issue was not considered significant because even though timber harvest is proposed in these areas, all actions would meet Forest Plan

Standards and Guidelines and would be consistent with agency policy of disclosing the effects of forest management in unroaded areas. Project analysis indicates that timber harvest and other actions would not result in adverse impact to any roadless values that currently exist. The affects of the proposed action and other alternatives on unroaded areas is presented in Chapter 3, Roadless and Unroaded Areas.

Social/Economics

Timber volume generated from the proposed harvest units vary with different silviculture prescriptions. Alternatives actions may have different effects on the local and regional economies regarding job creation for neighboring communities when one considers the volume per acre of timber products for this proposal, and potential fluctuations in selling values when timber sales are implemented (starting in fiscal year 2008).

This issue was not considered significant for designing alternatives to meet the purpose and need because all action alternatives provide similar positive economic benefits to the economy in providing jobs and contributing timber products to local markets. All action alternatives are economically viable. See Chapter 3 for a discussion of this issue.

Heritage Resources

The project area has some known cultural resource sites and contains high probability areas for additional, undiscovered sites. Timber harvest and other ground-disturbing actions could potentially affect heritage resources.

This issue was not considered significant because Federal laws and regulations require that cultural resources be protected either through avoidance or data recovery. Cultural resource surveys of the proposed project area have been completed. All surveyed and inventoried significant cultural resource sites in the Bridge Thin Project area would be buffered and excluded from resource management activities.

Carmen-Smith Hydroelectric Project

The Eugene Water and Electric Board (EWEB) operates transmission lines associated its Carmen-Smith Hydroelectric Project within this planning area. In 1958, EWEB applied for and was granted a 50-year license for the construction, operation, and maintenance of the project by the Federal Power Commission (FPC), with an effective date of December 1, 1958.

Since EWEB's Original License was issued for a period of 50 years, the utility is currently seeking a New License from the Federal Energy Regulatory Commission, or FERC, the successor to the FPC. The New License is scheduled to be issued on December 1, 2008. All parties to the re-licensing effort are currently participating in settlement negotiations regarding potential license terms and conditions. FERC is currently conducting an Environmental Analysis of the utility's proposal and would subsequently issue a New License with its Articles based on that analysis and the result of settlement negotiations.

At this time there are no proposals or decisions associated with this project which can be reliably or accurately analyzed in order to assess future effects that may contribute cumulative effects within the context of this EA. Therefore, this issue was not considered significant to development of project alternatives. Ongoing regular maintenance activities would continue into the future for the hydropower project. Comments were received from EWEB managers as mentioned above. Responses can be found in Appendix H. The Smith-Carmen Hydroelectric project and facilities were considered in project development, as addressed in Chapter 2, Mitigation Measures and Design Measures.

Chapter 2. Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Bridge Thin Project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., helicopter logging versus the use of skid trails) and some of the information is based upon the environmental effects of implementing each alternative (i.e., the amount of erosion or amount of spotted owl habitat altered).

Actions Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). The following Alternative design features were eliminated from detailed analysis for the reasons stated.

Exclusion of Helicopter Use
In response to initial public scoping comments that expressed concern for economic feasibility, an alternative that excluded helicopter use was evaluated. The District Ranger chose not to develop this alternative, and eliminated it from detailed study, as it resulted in a failure to meet the purpose and need by eliminating the option for treatment of too many units.
Exclusion of Silvicultural Treatments in Riparian Reserves
In response to initial public scoping comments that expressed concern about management activity in Riparian Reserves, an alternative that excluded silvicultural treatment within Riparian Reserves was evaluated. The District Ranger chose not to develop this alternative, and eliminated it from detailed study as it resulted in failure to meet the purpose and need to thin overly dense plantations in Riparian Reserves and accelerate restoration of late-successional habitat.
Exclusion of Silvicultural Treatments in Stands older than 80 Years
In response to initial public scoping comments that expressed concern about management activity in Stands older than 80 years, an alternative was considered that would not commercially harvest these older stands. The District Ranger chose not to fully develop this alternative because it would not address the need to conduct oak savanna restoration, which includes stands over 80 years old. However, Alternative C does exclude timber harvest in stands over 80 years old, with the exception of oak savanna restoration stands.
Alternative with No or Less Road Building
In response to initial public scoping comments that expressed concern about the impacts of new road construction and the re-opening of roads an alternative that involves no or less road construction was

evaluated. Road maintenance is the only proposed actions associated with forest system roads. No new system roads would be constructed in the proposed action alternative. Temporary road re-opening/development would be necessary to access activity units, and would not occur in riparian areas. The District Ranger chose not to develop this alternative, and eliminated it from detailed study as it resulted in failure to meet the purpose and need to restore structural diversity in stem exclusion stands to enhance wildlife, and provide a suistanable flow of timber product to the local economy.
Treatment of only Surface and Ladder Fuels
In response to initial public scoping comments that suggested the development of an alternative that would only treat surface and ladder fuels. The District Ranger chose not to develop this alternative, and eliminated it from detailed study as it resulted in failure to meet the projects purpose and need to produce a viable timber sale that will provide a sustainable supply of wood in support of the local and regional economy.

Alternatives Considered in Detail

Alternative A – the No Action Alternative

Alternative A assesses the current management situation of the affected environment and serves as a baseline to compare and describe the differences in effects between taking no action and implementing action alternatives to meet project objectives. Existing site specific management plans and standards and guidelines would continue to be the basis for management of the project area. Only those management activities planned and implemented under previous decisions would continue in the project area.

Many stands are overstocked; site resources are being fully utilized and inter-tree competition is intense. The effects of overstocking include decreased growth, increased rates of mortality and high risk for insect attack. High rates of mortality would increase fuel loading; this combined with ladder fuels puts these stands at high risk for a stand replacement wildfire. These conditions are not sustainable over time. Stand conditions that can favor the spread of insect and disease in proposed harvest units would continue unabated. Decline in underrepresented species, like sugar pine (*Pinus lambertiana*) and western red cedar (*Thuja plicata)*, would continue.

Seral stage diversity within the stands would remain low. In the absence of treatments including timber harvest and underburning, species tolerant to regenerating and growing under thick canopies would dominant the site over time. High stocking density and canopy closure would continue to restrict regeneration of Douglas fir, sugar pine, and western red cedar. The species composition in many stands would slowly shift from being dominated by species less tolerant of shade to more tolerant species like western hemlock.

Stands that are currently at a moderate to high stand density and experiencing a declining rate of growth would continue along current growth trends. Stand conditions that can favor the spread of bark beetle and root rot in proposed harvest units would continue unabated. Additionally, in the absence of prescribed fire treatments, fuel loading (ladder fuels and canopy closure) would remain high and continue to increase. This would result in conditions that are conducive for severe and high intensity wildfires. Fire suppression efforts would continue with the potential for larger and more dangerous wildfires to occur. Areas near structures and/or private residences would not have any reduction in fuels to aid in lessening wildfire intensity and mitigating hazards for firefighters.

Since no timber harvest would occur at this time, this alternative would not meet the purpose and need for action, including managing the project area to maintain stand health and vigor and provide multiple use benefits. Because no timber stand treatments are included in Alternative A, it would not meet the needs of restoring structural diversity in stem exclusion stands to enhance wildlife habitat; accelerating late-successional conditions for stands within riparian reserves; responding to the need to restore “open oak savannah” stands where they were historically present in the Bridge Thin project area. This alternative would also not respond to the need to reduce hazardous fuels and improve the role of fire as a natural disturbance process in the ecosystem or provide additional protection for communities in the wildland-urban interface.

The existing network of roads would remain unchanged. Normal scheduled road maintenance, such as brushing, culvert cleaning, and surface blading would continue in accordance with annual maintenance plans. Control of invasive plants would continue as currently programmed and funded.

Alternative A (No Action) as it Responds to the Significant Issues:

Water Quality/Aquatic Resources

Alternative A proposes no activities that would create new risks to soil and water resources. However, the alternative allows existing road related problems including erosion from roads currently in poor condition and barriers to aquatic passage to persist. Alternative A would also allow dense stagnant riparian stands resulting from prior regeneration harvest to persist.

Threatened Northern Spotted Owl

Alternative A proposes no activities that would change current trends of development of long-term sustainable habitat for the threatened spotted owl in the project area.

Alternative B – The Proposed Action

Alternative B would respond to the purpose and need by implementing timber harvest on 2,256 acres for a gross estimate of 47.8 million board feet (MMBF) of Forest products. This alternative is consistent with management direction set forth in the Willamette National Forest Plan. Figures 5 and 6 display the activity units in the project area. Table 2 presents the types of treatment for each unit in this alternative.

Alternative B – The Proposed Action
• Harvest - 2,256 acres
• Underburn - 1,266 acres
• Fuel thin - 142 acres
• Natural fuels underburn - 51 acres
• Grapple pile and burn - 397 acres
• Hand pile and burn - 264 acres

• Maintain existing system roads - 34.2 miles
• Re-open temporary spur roads (would be closed after use) - 1.8 miles
• Construct temporary spur roads (would be closed after use) - 3 miles

Vegetation

Harvest treatments include 145 acres of riparian thin, 391 acres of moderate thin, 1,368 acres of heavy thin, 30 acres of oak thin, and 190 acres of wildlife thin. Group selects (gaps) would be cut in stands to create holes to develop early seral habitat. Gaps would be placed within units: 2, 3, 8, 10, 20, 40, 42, 43, 44, 45, 46, and 68. Stand conditions and silvicultural prescriptions for the units in this alternative can be found on pages 66-84.

Alternative B would provide for underrepresented species, for example sugar pine and western redcedar. Natural regeneration opportunities in older stands with harvest (units 80, 81, 82, 83, 84, 841, 85, 88, and 91) would be increased by opening up the stand. sugar pine, a relatively shade intolerant species, has been shown to increase seed-to-seedling success from a ratio of (1:244 to 1:483) to (1:70) with disturbance under the seed trees (Fowells, et al).

Alternative B would implement harvest with approximately 770 acres of ground based yarding, 960 acres using skyline yarding systems, and 520 acres of helicopter yarding. This alternative allows for eight helicopter landings. The clearing for each landing would be approximately 0.5 acres in size.

Table 2. Alternative B Harvest Units.

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
1	14	HT-13, NT-1	M1	Heli	___	496	940	HP
2	140	HT-78, RT-48, NT-14	M1	Skyline:15 Ground: 115 Heli: 10	2909	3,170	6,014	GP/HP
3	47	HT-47	M1	Ground	___	1,343	2,547	GP
4	57	HT-55, NT-2	M1	Ground: 19 Heli: 38	___	914	1,734	GP/HP
5	73	HT-69, NT-4	M1	Ground: 54 Heli: 19	1287	1,710	3,244	UB[1]/GP/HP
6	87	HT-76, RT-7, NT-4	M1	Skyline: 48 Ground: 22 Heli: 17	643	2,178	4,132	UB[1]/GP/HP
8	60	HT-54, RT-5, NT-1	M1	Ground	1099	934	1,771	GP
10	37	HT-36, NT-1	M1	Ground	1077	367	696	UB
11	37	HT-30, NT-7	M1	Skyline	___	478	907	HP
12	21	HT-14, NT-7	M1	Skyline	___	177	337	HP
13	21	HT-16, RT-3, NT-2	M1	Heli	___	385	731	HP
14	27	HT-27	M1	Heli	___	664	1,259	HP

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
15	79	HT-59, RT-12, NT-8	M1	Heli	1568	1,994	3,783	HP
17	24	HT-18, RT-4, NT-2	M1	Heli	___	282	534	HP
18	27	HT-24, RT-2, NT-1	M1	Heli	___	278	527	HP
20	66	MT-66	M1	Ground	832	1,161	2,202	UB
21	12	MT-9, NT-3	M1	Ground	737	49	93	GP
23	12	MT-11, NT-1	M1	Ground	___	118	224	GP
24	5	MT-5	M1	Ground	___	32	61	HP
25	26	HT-26	M1	Skyline	___	789	1,496	HP
26	14	MT-14	M1	Ground: 11 Heli: 3	___	342	648	UB
27	5	HT-5	M1	Skyline	___	84	159	UB
28	7	HT-5 RT-1, NT-1	M1	Skyline: 2 Ground: 5	___	282	534	GP/HP
29	47	HT-45, RT-1, NT-1	M1	Ground: 6 Heli: 41	___	827	1,568	UB[1]/GP/HP
30	38	HT-38	M1	Ground: 9 Heli: 29	829	1,173	2,225	GP/HP
31	19	HT-19	M1	Skyline: 1 Heli: 18	___	344	652	UB[1]/HP
32	123	MT-123	M1	Skyline	5141	1,787	3,390	UB
34	5	MT-5	M1	Skyline	___	95	180	UB
35	54	HT-54	M1	Skyline: 48 Ground: 6	1393	1,136	2,154	GP/HP
36	36	HT-34, NT-2	M1	Skyline	1146	827	1,569	HP
37	43	HT-39, RT-4	M1	Skyline	345	782	1,482	HP
38	27	HT-27	M1	Skyline	___	525	997	UB
39	20	HT-20	M1	Skyline: 18 Ground: 2	341	373	708	UB[1]/HP
40	27	WT-14, RT-11, NT-2	M1	Skyline: 5 Ground: 22	___	837	1,588	UB
42	32	WT-32	M1	Skyline	___	412	781	UB
43	44	WT-26, RT-11, NT-7	M1	Skyine: 5 Ground: 39	625	1,379	2,616	UB[1]/GP/HP
44	45	WT-41, RT-2, NT-2	M1	Ground	___	1,512	2,867	GP
45	38	WT-26, RT-9, NT-3	M1	Skyline: 21 Ground 17	802	864	1,640	GP/HP
46	41	HT-41	M1	Skyline: 36 Ground: 5	857	476	904	UB[1]/GP/HP
47	32	HT-26, RT-3,	M1	Skyline	___	720	1,365	HP

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
		NT-3						
48	17	HT-17	M1	Ground	___	370	702	GP
49	7	HT-4, RT-2, NT-1	M1	Ground	___	119	227	GP
50	6	____	M1	____	____	____	____	FT
51	20	HT-18, NT-2	M1	Skyline	___	501	950	HP
52	11	HT-11	M1	Skyline	114	205	388	UB[1]/HP
53	3	HT-3	M1	Skyline	___	32	61	UB
54	10	HT-10	M1	Ground	___	307	581	GP
55	25	HT-24, NT-1	M1	Skyline	473	659	1,251	UB[1]/HP
56	44	HT-41, NT-3	M1	Heli	___	2,074	3,935	UB
57	15	HT-15	M1	Heli	___	654	1,241	UB
58	16	MT-16	M1	Skyline	___	140	266	UB[1]/HP
59	22	HT-22	M1	Skyline: 16 Heli: 6	___	1,126	2,135	UB
60	24	MT-23, NT-1	M1	Skyline: 14 Ground: 10	762	189	359	UB
61	16	HT-12, RT-4	M1	Ground	___	426	809	UB[1]/GP
62	19	MT-19	M1	Ground	801	123	233	UB
63	29	HT-29	M1	Skyline: 14 Heli: 15	___	798	1,514	HP
64	42	MT-41, NT-1	M1	Skyline: 36 Ground: 6	1346	548	1,040	GP/HP
65	10	MT-10	M1	Skyline	___	178	337	HP
66	11	MT-10, NT-1	M1	Skyline: 1 Ground: 10	___	116	220	UB
67	22	MT-22	M1	Ground	___	296	561	UB
68	41	WT-41	M1	Skyline: 31 Ground: 10	___	542	1,028	UB
69	33	HT-32, NT-1	M1	Skyline: 18 Ground: 15	___	1,109	2,103	UB[1]/GP/HP
70	3	MT-3	M1	Skyline	395	15	28	UB
72	28	HT-27, NT-1	M1	Skyline: 20 Ground: 8 .	___	123	233	UB
80	10	WT-10	M2	Skyline	___	650	1,232	UB
81	14	MT-14	M2	Skyline	___	579	1,099	UB
82	35	HT-17, NT-18	M2	Skyline	___	479	909	UB
83	17	HT-11, NT-6	M2	Skyline	___	244	462	UB
84	32	OT-19, RT-8, NT-5	M2	Skyline: 24 Heli: 8	___	1,002	1,901	UB
841	26	HT-22, NT-4	M2	Skyline	___	521	988	UB

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
85	12	OT-11, NT-1	M2	Heli	___	33	63	UB
86	7	___	M2	___	___	___	___	NFUB
87	2	___	M2	___	___	___	___	NFUB
88	36	HT-23, RT-8, NT-5	M2	Skyline: 9 Ground: 27	___	854	1,621	UB
89	6	___	M2	___	___	___	___	FT
91	38	HT-35, NT-3	M2	Skyline: 19 Heli: 19	___	244	462	UB
95	27	___	M2	___	___	___	___	FT
96	10	___	M2	___	___	___	___	FT
97	5	___	M2	___	___	___	___	FT
98	4	___	M2	___	___	___	___	FT
99	13	___	M2	___	___	___	___	FT
100	42	___	M2	___	___	___	___	NFUB
101	12	___	M2	___	___	___	___	FT
102	33	___	M2	___	___	___	___	FT
103	26	___	M2	___	___	___	___	FT
Totals	**2,449**	**2,256**	___	___	**25,552**	**47,758**	**90,391**	___

Fuels Treatment

All units in Alternative B would receive fuel treatments to reduce logging slash and return the disturbance process of fire to the ecosystem. Treatments include underburning (UB) harvest activity fuels under a residual overstory, and the piling and burning of landing, hand piles (HP), or grapple/machine piles (GP). See Table 2 for stand treatment by unit.

All units with harvest activities would have landing piles burned following harvest. Units with hand piling treatments would be focused along the roadsides up to100 ft. into the unit or areas of concentrations within the unit. Hand piling would make roads more effective as fuel breaks for

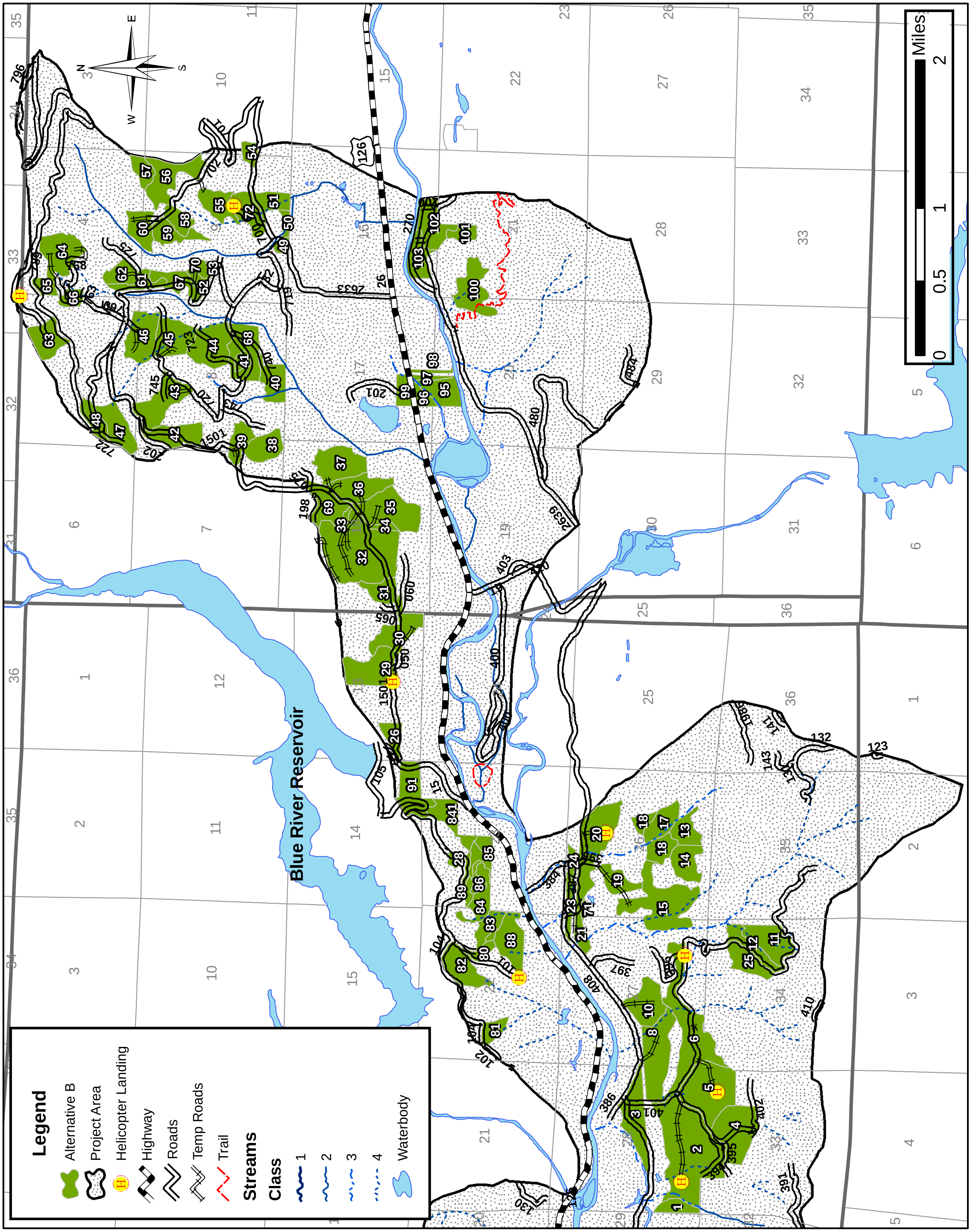


Figure 5. Bridge Thin Project Area - Alternative B (Eastern Section).

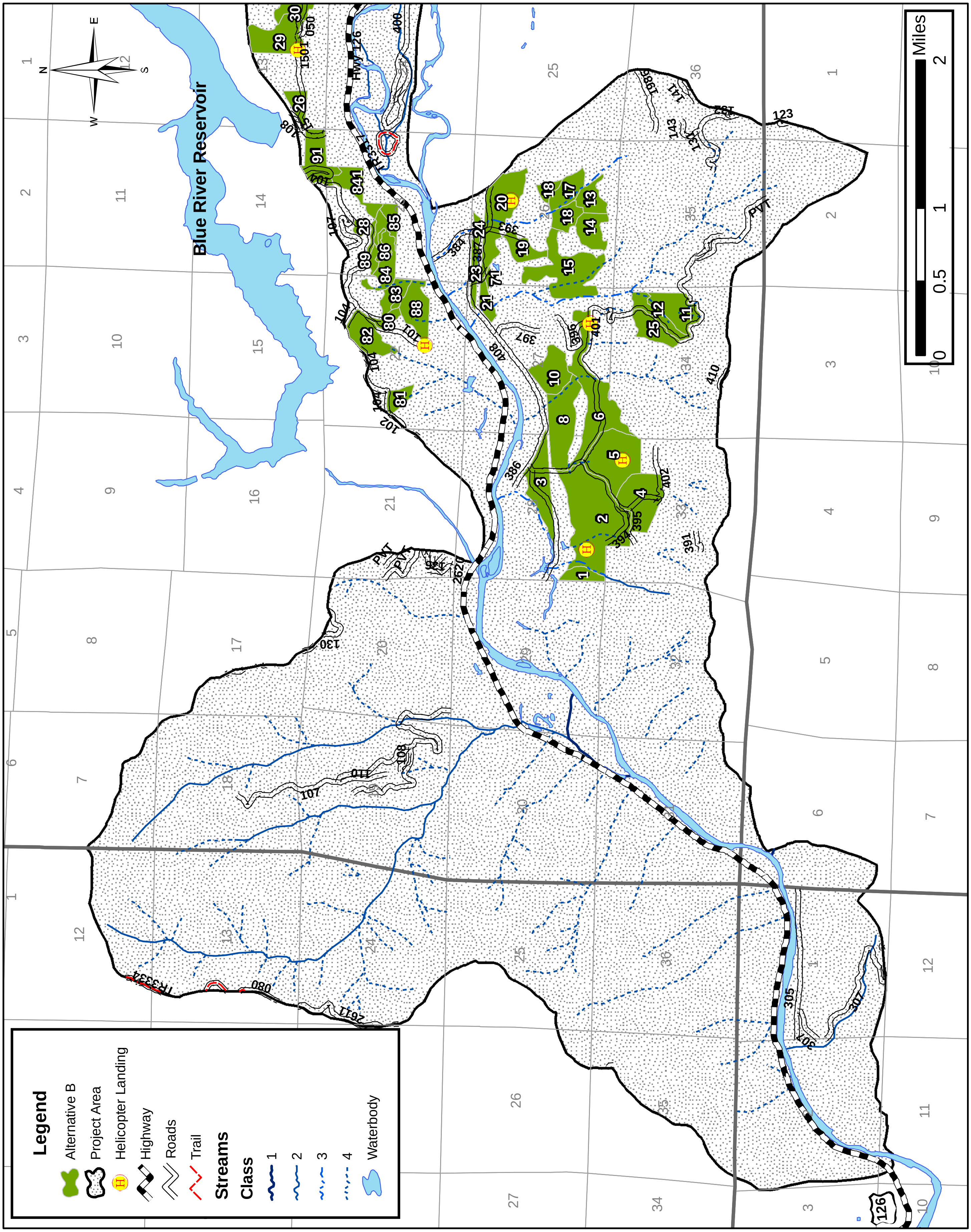


Figure 6. Bridge Thin Project Area - Alternative B (Western Section).

wildfire suppression. Pile burning of landings, hand piles, and grapple/machine piles should take place in the fall or winter season when fire should not spread outside of the piles. Alternative biomass utilization would occur if a market exists for wood fiber or firewood.

Prescribed fire to treat logging slash would take place during the spring season, or when weather and fuels are in spring-like conditions. Spring-like conditions are defined as:

Spring-like conditions are defined as:
• Fuels ≥3” in diameter (1,000 hour fuels) have fuel moistures of 25% or greater,
• Soil moistures and duff moistures are damp, at levels where duff consumption could be limited to 30-40% across the unit, and
• When mortality of overstory trees would be low.

Fuels thins (FT) are non-commercial harvests that would occur in Units 50, 89, 95-99, 101-103 (See Table 2). Fuels thins would involve reducing the brush and trees <7” DBH throughout the unit. This would reduce the ladder fuels and the understory density that increase the potential for high intensity wildfires. Fuels may be treated in different ways depending on efficiency and funding. Units could be cut by hand, followed by hand piling and burning or the units may be processed with a machine that would grapple pile or chip/mulch the fuels. The treatment of mulching/chipping would change the fuel loading to a more compact profile, thus reducing lofty and flammable fuels to a less hazardous profile. The fuels thins would reduce the ladder fuels and the horizontal and vertical continuity of the vegetation. Reducing these fuels help create part of the defensible space next to structures or private land and along the highway where burning rubbish thrown from cars can ignite wildfires.

The proposed treatment of Unit 100 would be a natural fuels underburn. This unit is along King Road next to private land. Due to the location the underburn, it can be completed safely with predominant winds blowing uphill and away from structures. A natural fuels underburn would provide a reduction in the hazardous fuels by reducing 1, 10, and part of the 100 hours fuels on the ground, and in the ladder fuels and canopy cover. Mortality in these stands would be around 20% or less. Underburning is a preferred method of treatment not only to reduce hazardous fuels but to return fire to the ecosystem. Units 86 and 87 are also proposed for natural fuels underburns. The units would be burned in conjuction with the bordering units; they would not be underburned individually.

Roads

For Alternative B, approximately 33.6 miles of existing forest roads would be maintained to allow access to harvest areas for timber haul (See Figure 7) and to reduce adverse impacts to resources., and another 0.6 mile of road would receive spot rocking and other road maintenance to support rock haul, for a total of 34.2 miles of road maintenance. Road maintenance activities would include felling danger trees, clearing and grubbing, replacing drainage structures, removing slides, repairing holes in the roadbed, reconstructing ditches, and placement of aggregate surfacing. Fourty-two new/replacement culverts would be installed as part of road maintenance activites (see Figure_). This

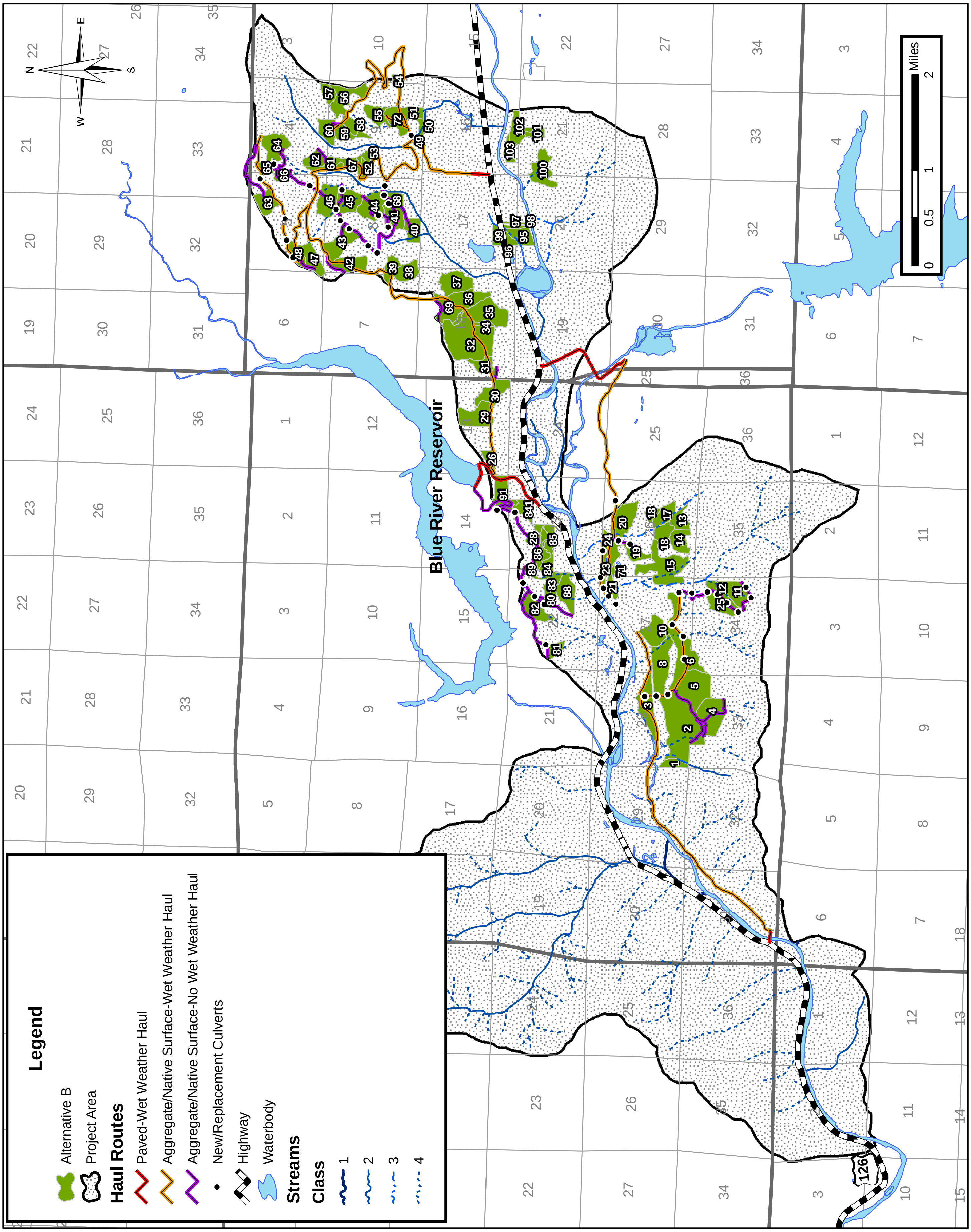


Figure 7. Haul Route and New/Replacement Culvert Locations- Alternative B.

includes stream crossing replacements listed in Table 3. The stream crossing culvert replacement projects listed in Table 3 would occur on existing roads designated for haul in this project. All stream-crossing improvements would accommodate 100-year flood events.

Table 3. Stream Crossing Culvert Replacement.

Road Number	Existing Condition	Proposed Treatment	Description of Associated Maintenance Activities
2633-720	Closed	Reconstruction	Redesign Mill Creek crossing to pass 100 year peak flows, and allow aquatic wildlife passage.
1900-408	Open	Reconstruction	Redesign unnamed creek crossings to protect water quality.

Existing open roads would be reduced by a total of 0.2 miles with gate or berm closure. Additionally, 0.3 miles of existing closed roads would be decommissioned (see Soils, Watershed, and Fisheries protection Mitigation #16 for description).

Alternative B would also construct about 16,000 feet of new temporary roads and utilize 9,500 feet of unclassified roads to allow access to harvest. Upon completion of sale activities, the temporary roads would be decommissioned.

Table 4. Roads Decommissioning for Alternative B.

Road Number	Existing Condition	Proposed Road Treatment	Description of Associated Treatment Activities	Miles Affected
1500-100	Open	Close	Berm entrance	0.2
2633-723	Closed	Decommission, end of road only	Remove culvert and fill at MP 0.6, outslope and install waterbars to end of road at MP 0.7	0.1
2633-761	Closed	Decommission road east of creek	Berm entrance, maintain drainage *	0.1
2633-763	Closed	Decommission road east of creek	Berm entrance, maintain drainage *	0.1
Total				0.5

* Some segments are presently in stable condition and may not require physical treatment to stabilize before re-classifying to “decommissioned.”

Alternatives B as it Responds to the Significant Issues:

Water Quality/Aquatic Resources

Alternative B includes 19 specific Best Management Practices (BMPs) that provide for the protection of soil, water, and fisheries resources, as required project mitigation. The riparian reserve thinning strategy also provides for the retention of effective stream shading vegetation and adequate levels of large wood in riparian reserves that occur in proposed partial cutting units. Silvicultural and fuels treatments within riparian reserves are prescribed at distances sufficient to maintain or improve aquatic habitat condition.

Alternative B proposes to thin 145 acres of riparian reserve and prescribed fire treatment in thinned riparian reserve areas. These activities are expected to create stand conditions that favor the accelerated development of future large wood and other late successional stand characteristics. This alternative would provide greater immediate diversity of patches and openings compared to the no action alternative, and would create conditions that result in greater plant species richness in thinned portions of riparian reserves.

Alternative B replaces existing drainage features (aged culverts and resized culvert diameters to accommodate 100-year flood flows) and proposes additional drainage structures (ditch relief culverts) that benefit aquatic species habitat downstream of project area roads. It includes road maintenance and reconstruction on 34.2 miles of road. This alternative also closes 0.2 miles of currently open roads. Approximately 0.3 miles of currently unneeded roads would also be decommissioned.

Threatened Northern Spotted Owl

All owl sites at risk from disturbance are protected through seasonal restrictions, which are listed under Wildlife Mitigation Measure #4. No occupied breeding habitat is altered under this alternative. Effects to non-breeding habitat are in compliance with standards and guidelines from the Willamette Forest Plan and U.S. Fish and Wildlife Service guidance. High quality nesting habitat would be protected. Dispersal habitat would be removed within 7 spotted owl home ranges, for a total of 228 acres. Dispersal habitat would be thinned on approximately 1856 acres, yet would maintain a 40% canopy cover and therefore, will continue to function as dispersal habitat.

Alternative C

Alternative C would respond to the project purpose and needs, while avoiding timber harvest in stands 80 years or older (140 acres), with the exception of the oak savannah restoration stands. Alternative C would implement timber harvest on 2,080 acres for a gross estimate of 44.2 million board feet (MMBF) of Forest products. This alternative is consistent with management direction set forth in the Willamette National Forest Plan. Figures 8 and 9 display the Alternative C activity units within the Bridge Thin Project area. Table 5 presents the types of treatment for each unit in this alternative.

Alternative C
• Harvest - 2,080 acres
• Underburn - 1,133 acres
• Fuel thin - 142 acres
• Natural fuels underburn – 49 acres
• Grapple pile and burn - 397 acres
• Hand pile and burn - 264 acres
• Maintain existing system roads - 33.7 miles
• Re-open of temporary spur roads (would be closed after use) - 1.8 miles
• Construct new temporary spur roads (would be closed after use) - 3 miles

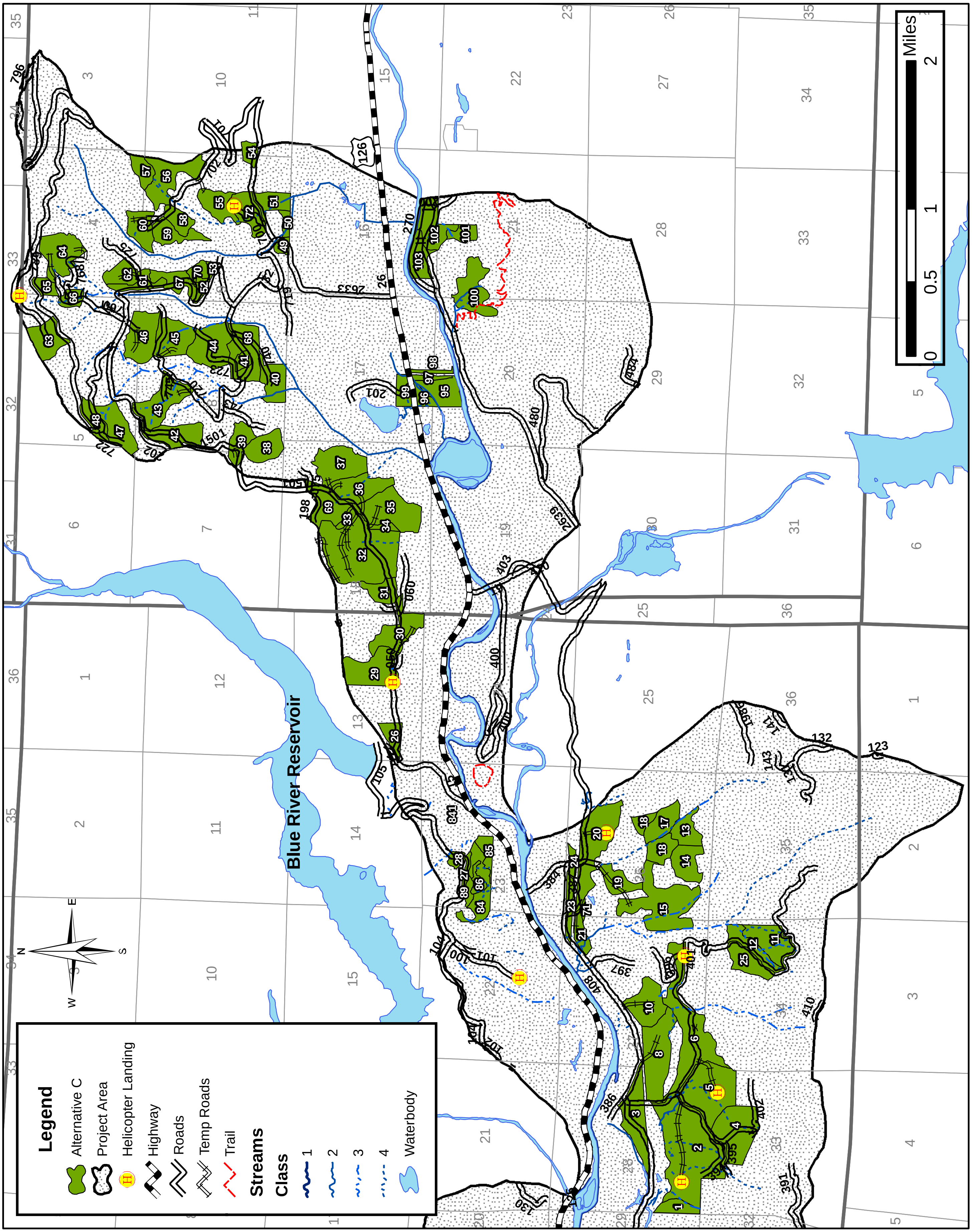


Figure 8. Bridge Thin Project Area - Alternative C (Eastern Section).

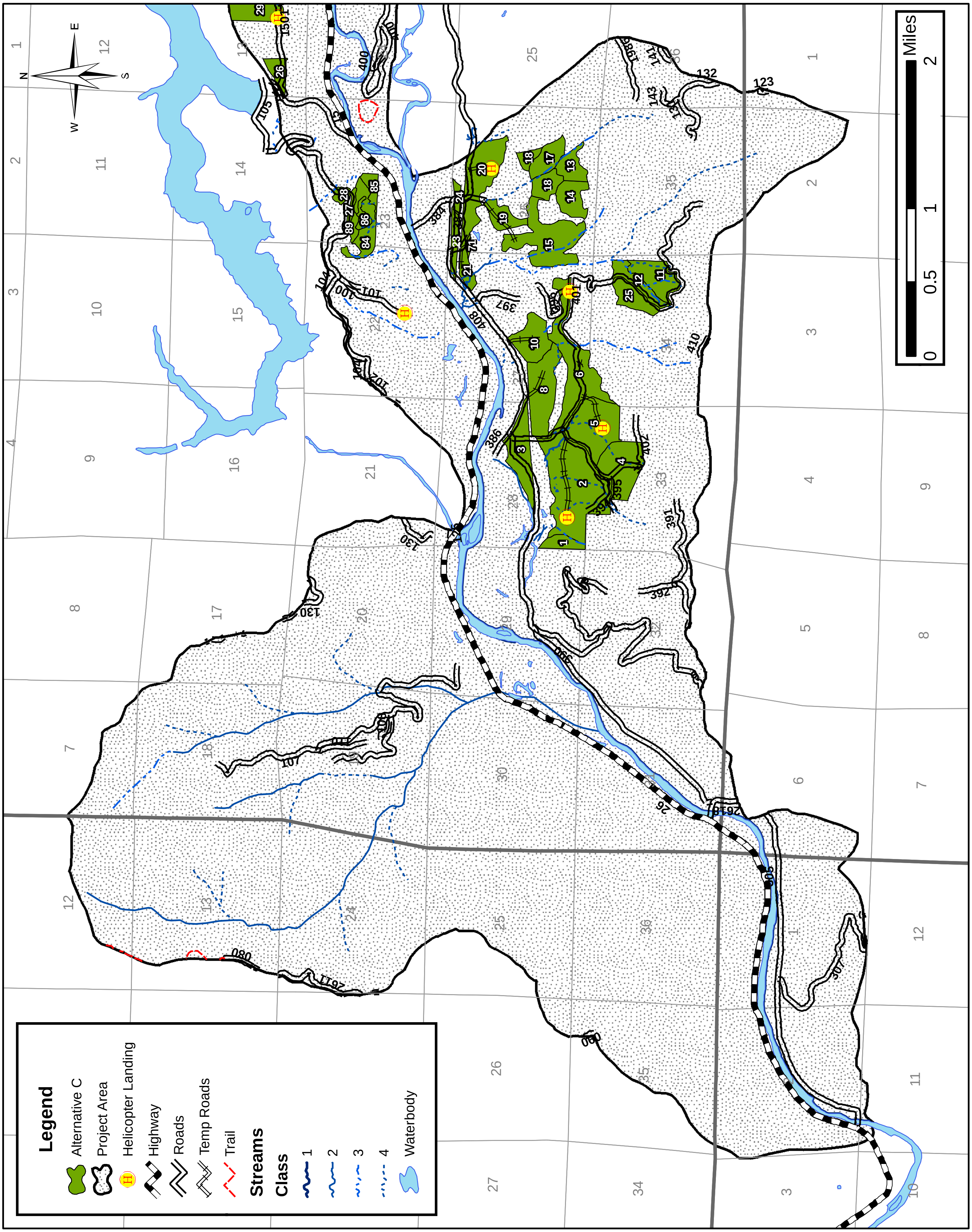


Figure 9. Bridge Thin Project Area - Alternative C (Western Section).

Vegetation

Harvest treatments include 137 acres of riparian thin, 377 acres of moderate thin, 1,260 acres of heavy thin, 30 acres of oak thin, and 180 acres of wildlife thin. Group selects (gaps) would be cut in stands to create holes to develop early seral habitat. Gaps would be placed within units: 2, 3, 8, 10, 20, 40, 42, 43, 44, 45, 46, and 68. Stand conditions and silvicultural prescriptions for the units in this alternative can be found on pages 66-84

Alternative C would implement harvest with approximately 760 acres of ground based yarding, 830 acres using skyline yarding systems, and 500 acres of helicopter yarding. This alternative allows for eight helicopter landings. The clearing for each landing would be approximately 0.5 acres in size.

Table 5. Alternative C Harvest Units.

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
1	14	HT-13, NT-1	M1	Heli	___	496	940	HP
2	140	HT-78, RT-48, NT-14	M1	Skyline:15 Ground: 115 Heli: 10	2909	3,170	6,014	GP/HP
3	47	HT-47	M1	Ground	___	1,343	2,547	GP
4	57	HT-55, NT-2	M1	Ground: 19 Heli: 38	___	914	1,734	GP/HP
5	73	HT-69, NT-4	M1	Ground: 54 Heli: 19	1287	1,710	3,244	UB[1]/GP/HP
6	87	HT-76, RT-7, NT-4	M1	Skyline: 48 Ground: 22 Heli: 17	643	2,178	4,132	UB[1]/GP/HP
8	60	HT-54, RT-5, NT-1	M1	Ground	1099	934	1,771	GP
10	37	HT-36, NT-1	M1	Ground	1077	367	696	UB
11	37	HT-30, NT-7	M1	Skyline	___	478	907	HP
12	21	HT-14, NT-7	M1	Skyline	___	177	337	HP
13	21	HT-16, RT-3, NT-2	M1	Heli	___	385	731	HP
14	27	HT-27	M1	Heli	___	664	1,259	HP
15	79	HT-59, RT-12, NT-8	M1	Heli	1568	1,994	3,783	HP
17	24	HT-18, RT-4, NT-2	M1	Heli	___	282	534	HP
18	27	HT-24, RT-2, NT-1	M1	Heli	___	278	527	HP
20	66	MT-66	M1	Ground	832	1,161	2,202	UB
21	12	MT-9, NT-3	M1	Ground	737	49	93	GP

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
23	12	MT-11, NT-1	M1	Ground	___	118	224	GP
24	5	MT-5	M1	Ground	___	32	61	HP
25	26	HT-26	M1	Skyline	___	789	1,496	HP
26	14	MT-14	M1	Ground: 11 Heli: 3	___	342	648	UB
27	5	HT-5	M1	Skyline	___	84	159	UB
28	7	HT-5 RT-1, NT-1	M1	Skyline: 2 Ground: 5	___	282	534	GP/HP
29	47	HT-45, RT-1, NT-1	M1	Ground: 6 Heli: 41	___	827	1,568	UB[1]/GP/HP
30	38	HT-38	M1	Ground: 9 Heli: 29	829	1,173	2,225	GP/HP
31	19	HT-19	M1	Skyline: 1 Heli: 18	___	344	652	UB[1]/HP
32	123	MT-123	M1	Skyline	5141	1,787	3,390	UB
34	5	MT-5	M1	Skyline	___	95	180	UB
35	54	HT-54	M1	Skyline: 48 Ground: 6	1393	1,136	2,154	GP/HP
36	36	HT-34, NT-2	M1	Skyline	1146	827	1,569	HP
37	43	HT-39, RT-4	M1	Skyline	345	782	1,482	HP
38	27	HT-27	M1	Skyline	___	525	997	UB
39	20	HT-20	M1	Skyline: 18 Ground: 2	341	373	708	UB[1]/HP
40	27	WT-14, RT-11, NT-2	M1	Skyline: 5 Ground: 22	___	837	1,588	UB
42	32	WT-32	M1	Skyline	___	412	781	UB
43	44	WT-26, RT-11, NT-7	M1	Skyine: 5 Ground: 39	625	1,379	2,616	UB[1]/GP/HP
44	45	WT-41, RT-2, NT-2	M1	Ground	___	1,512	2,867	GP
45	38	WT-26, RT-9, NT-3	M1	Skyline: 21 Ground 17	802	864	1,640	GP/HP
46	41	HT-41	M1	Skyline: 36 Ground: 5	857	476	904	UB[1]/GP/HP
47	32	HT-26, RT-3, NT-3	M1	Skyline	___	720	1,365	HP
48	17	HT-17	M1	Ground	___	370	702	GP
49	7	HT-4, RT-2, NT-1	M1	Ground	___	119	227	GP
50	6	____	M1	____	____	____	____	FT
51	20	HT-18, NT-2	M1	Skyline	___	501	950	HP
52	11	HT-11	M1	Skyline	114	205	388	UB[1]/HP

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
53	3	HT-3	M1	Skyline	___	32	61	UB
54	10	HT-10	M1	Ground	___	307	581	GP
55	25	HT-24, NT-1	M1	Skyline	473	659	1,251	UB[1]/HP
56	44	HT-41, NT-3	M1	Heli	___	2,074	3,935	UB
57	15	HT-15	M1	Heli	___	654	1,241	UB
58	16	MT-16	M1	Skyline	___	140	266	UB[1]/HP
59	22	HT-22	M1	Skyline: 16 Heli: 6	___	1,126	2,135	UB
60	24	MT-23, NT-1	M1	Skyline: 14 Ground: 10	762	189	359	UB
61	16	HT-12, RT-4	M1	Ground	___	426	809	UB[1]/GP
62	19	MT-19	M1	Ground	801	123	233	UB
63	29	HT-29	M1	Skyline: 14 Heli: 15	___	798	1,514	HP
64	42	MT-41, NT-1	M1	Skyline: 36 Ground: 6	1346	548	1,040	GP/HP
65	10	MT-10	M1	Skyline	___	178	337	HP
66	11	MT-10, NT-1	M1	Skyline: 1 Ground: 10	___	116	220	UB
67	22	MT-22	M1	Ground	___	296	561	UB
68	41	WT-41	M1	Skyline: 31 Ground: 10	___	542	1,028	UB
69	33	HT-32, NT-1	M1	Skyline: 18 Ground: 15	___	1,109	2,103	UB[1]/GP/HP
70	3	MT-3	M1	Skyline	395	15	28	UB
72	28	HT-27, NT-1	M1	Skyline: 20 Ground: 8 .	___	123	233	UB
84	32	OT-19, RT-8, NT-5	M2	Skyline: 24 Heli: 8	___	1,002	1,901	UB
85	12	OT-11, NT-1	M2	Heli	___	33	63	UB
86	7	___	M2	___	___	___	___	NFUB
89	6	___	M2	___	___	___	___	FT
95	27	___	M2	___	___	___	___	FT
96	10	___	M2	___	___	___	___	FT
97	5	___	M2	___	___	___	___	FT
98	4	___	M2	___	___	___	___	FT
99	13	___	M2	___	___	___	___	FT

Unit	Acres	Harvest Prescription [1] (acres)	Stand History [2] (acres)	Logging Systems (acres)	Temp Roads (feet)	Gross Estimated Timber Volume (MBF / CCF)		Fuels Treat-ment [4]
100	42	___	M2	___	___	___	___	NFUB
101	12	___	M2	___	___	___	___	FT
102	33	___	M2	___	___	___	___	FT
103	26	___	M2	___	___	___	___	FT
Totals	**2,271**	**2,080**	**___**	**___**	**25,552**	**44,187**	**83,618**	**___**

Fuels Treatment

All units in Alternative C would receive fuel treatments to reduce logging slash and return the disturbance process of fire to the ecosystem. Treatments include underburning (UB) harvest activity fuels under a residual overstory, and the piling and burning of landing, hand piles (HP), or grapple/machine piles (GP). See Table 4 for stand treatment by unit.

All units with harvest activities would have landing piles burned following harvest. Units with hand piling treatments would be focused along the roadsides up to 100 ft. into the unit or areas within the unit. Hand piling would make roads more effective as fuel breaks for wildfire suppression. Pile burning of landings, hand piles, and grapple/machine piles should take place in the fall or winter season when fire should not spread outside of the piles. Alternative biomass utilization would occur if a market exists for wood fiber or firewood.

Prescribed fire to treat logging slash would take place during the spring-like season, or when weather and fuels are in spring-like conditions.

Spring-like conditions are defined as:
• Fuels ≥3” in diameter (1,000 hour fuels) have fuel moistures of 25% or greater,
• Soil moistures and duff moistures are damp, at levels where duff consumption could be limited to 30-40% across the unit, and
• When mortality of overstory trees would be low.

Fuels thins (FT) are non-commercial harvests that would occur in Units 50, 89, 95-99, and 101-103 (See Table 5). Fuels thins would involve reducing the brush and trees <7” DBH throughout the unit. This would reduce the ladder fuels and the understory density that increase the potential for high intensity wildfires. Fuels may be treated in different ways depending on the feasibility and funding. Units could be cut by hand, followed by hand piling and burning or the units may be processed with a machine that would grapple pile or chip/mulch the fuels. The treatment of mulching/chipping would change the fuel loading to a more compact profile, thus reducing lofty and flammable fuels to a less hazardous profile. The fuels thins would reduce the ladder fuels and the horizontal and vertical continuity of the vegetation. Reducing these fuels help create part of the defensible space next to structures or private land and along the highway where burning rubbish thrown from cars can ignite wildfires.

The proposed treatment of Unit 100 would be a natural fuels underburn or fuels thin. This unit is along King Road, next to private land, and due to the location the underburn can be completed safely with predominant winds blowing uphill and away from structures. A natural fuels underburn would provide a reduction in the hazardous fuels by reducing 1, 10, and part of the 100 hours fuels on the ground, the ladder fuels and canopy cover. Mortality in these stands would be around 20% or less. Underburning is a preferred method of treatment not only to reduce hazardous fuels but to return fire to the ecosystem. The proposed treatment of Unit 86 is also a natural fuels underburn. Treatment would be done in conjunction with the fuels treatments in the oak units 84 and 85

Roads

For Alternative C, approximately 33.1 miles of existing forest roads would be maintained to allow access to harvest areas for timber haul (See Figure 10) and to reduce adverse impacts to resources, and another 0.6 miles of road used only for rock haul from rock quarries would receive spot rocking and other road maintenance, for a total of 33.7 miles of road maintenance. Road maintenance activities would include felling hazard trees, clearing and grubbing, replacing drainage structures, removing slides, repairing holes in the roadbed, reconstructing ditches, and placement of aggregate surfacing. Fourty-five new/replacement culverts would be installed as part of road maintenance activites (see Figure10). This includes stream crossing replacements listed in Table 6. The stream crossing culvert replacement projects listed in Table6 would occur on existing roads designated for haul in this project. All stream-crossing improvements would accommodate 100-year flood events.

Table 6. Stream Crossing Culvert Replacement.

Road Number	Existing Condition	Proposed Treatment	Description of Associated Maintenance Activities
2633-720	Closed	Reconstruction	Redesign Mill Creek crossing to pass 100 year peak flows, and allow aquatic wildlife passage.
1900-408	Open	Reconstruction	Redesign unnamed creek crossings to protect water quality.

Existing open roads would be reduced by a total of 0.2 miles with gate or berm closure. Additionally, 0.3 miles of existing closed roads would be decommissioned (see Soils, Watershed, and Fisheries protection Mitigation #16 for description).

Alternative C would also construct about 16,000 feet of new temporary roads and utilize about 9,500 feet of unclassified roads to allow access to harvest. Upon completion of sale activities, the temporary roads would be decommissioned.

Table 7. Roads Decommissioning for Alternative C.

Road Number	Existing Condition	Proposed Road Treatment	Description of Associated Treatment Activities	Miles Affected
1500-100	Open	Close	Berm entrance, maintain drainage	0.2
2633-723	Closed	Decommission, end of road only	Remove culvert and fill at MP 0.6, outslope and install waterbars to end of road at MP 0.7	0.1

Road Number	Existing Condition	Proposed Road Treatment	Description of Associated Treatment Activities	Miles Affected
2633-761	Closed	Decommission road east of creek	Berm entrance, maintain drainage *	0.1
2633-763	Closed	Decommission road east of creek	Berm entrance, maintain drainage *	0.1
Total				0.5

* Some segments are presently in stable condition and may not require physical treatment to stabilize before re-classifying to "decommissioned."

Alternatives C as it Responds to the Significant Issues:

Water Quality/Aquatic Resources

Alternative C includes 19 specific Best Management Practices (BMPs) that provide for the protection of soil, water, and fisheries resources, as required project mitigation. The riparian reserve thinning strategy also provides for the retention of effective stream shading vegetation and adequate levels of large wood in riparian reserves that occur in proposed partial cutting units. Silvicultural and fire treatments within riparian reserves are prescribed at distances sufficient to maintain or improve aquatic habitat condition.

Alternative C proposes to thin 137 acres of riparian reserve and prescribed fire treatment in thinned riparian reserve area. These activities are expected to create stand conditions that favor the accelerated development of future large wood and other late successional stand characteristics. This alternative would provide greater immediate diversity of patches and openings compared to the no action alternative, and would create conditions that result in greater plant species richness in thinned portions of riparian reserves.

Alternative C replaces existing drainage features (aged culverts and resized culvert diameters to accommodate 100-year flood flows) and proposes additional drainage structures (ditch relief culverts) that benefit aquatic species habitat downstream of project area roads.

It includes road maintenance on 34 miles of road. This alternative also closes 0.2 miles of currently open roads. Approximately 0.3 miles of currently unneeded roads would also be decommissioned.

Threatened Northern Spotted Owl

All the sites at risk from disturbance are protected through seasonal restrictions which are listed under Wildlife Mitigation Measure #4. No occupied breeding habitat is altered under this alternative. Effects to non-breeding habitat are in compliance with standards and guidelines from the Willamette Forest Plan and U.S. Fish and Wildlife Service guidance. High quality nesting habitat would be protected. Dispersal habitat would be removed within 7 spotted owl home ranges, for a total of 218 acres. These stands are expected to recover to the 40% canopy within 8-10 years. Dispersal habitat would be thinned on approximately 1690 acres, yet would maintain a 40% canopy cover and therefore, will continue to function as dispersal habitat.

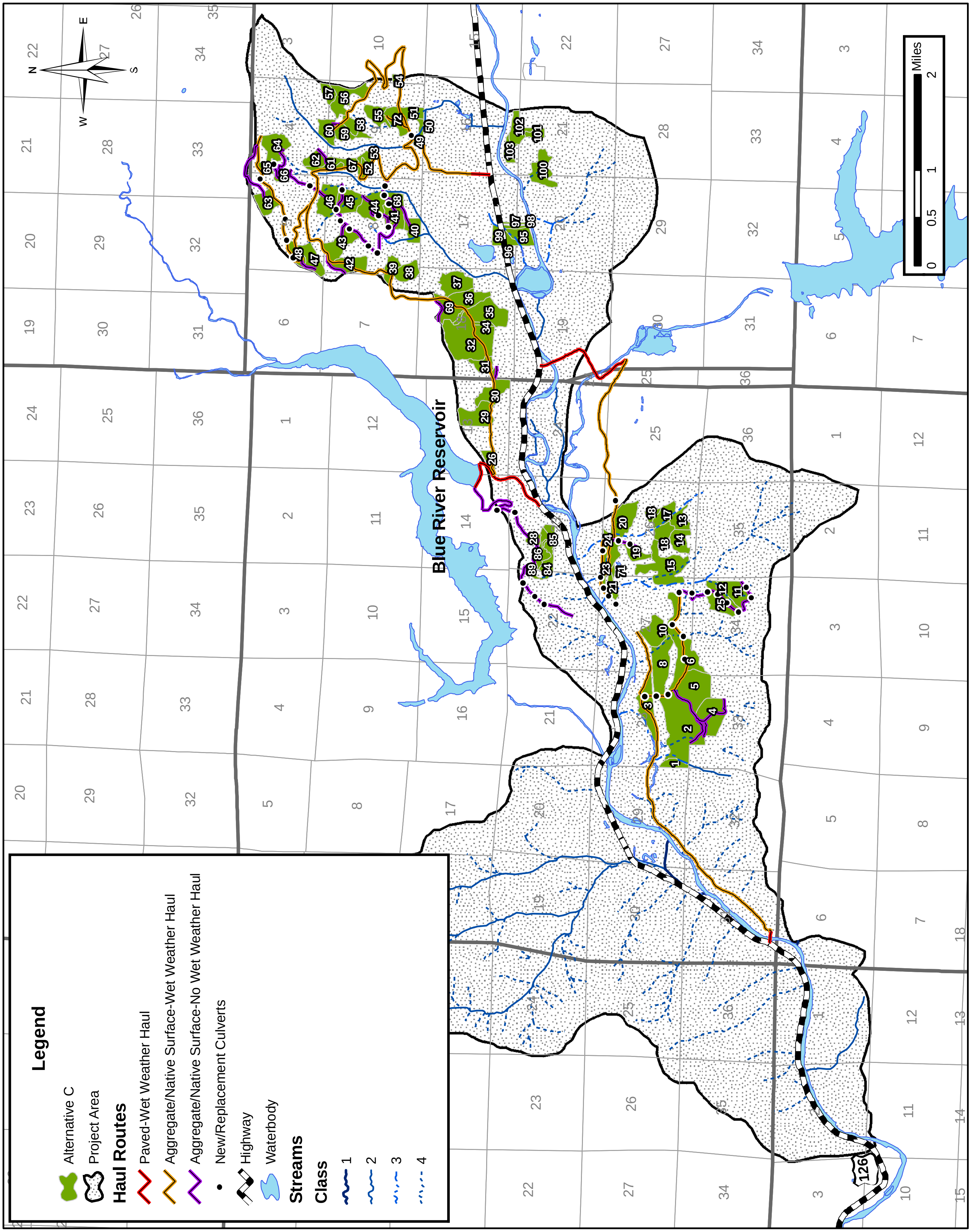


Figure 10. Haul Route and New/Replacement Culvert Locations- Alternative C.

Other Connected Actions and Similar Actions Common to All Action Alternatives

Rock Quarry Development at Mill Creek Rock Quarry

The existing Mill Creek Rock Quarry would be further developed to produce crushed aggregate, pit run aggregate, and riprap for road maintenance needs (see Figure 11). Development at this pit includes removal of soil overburden, drilling and blasting, reducing existing oversize material, and eventual rehabilitation of the site. Currently the Mill Creek Rock Quarry area is 4 acres and 0.5 acre of new development is planned.

Development at this quarry would conform to requirements in the respective pit development plans, which are included in the project analysis file. The anticipated volume of material needed for road maintenance is less than 15,000 cubic yards, and the development plans would specify the location and dimensions of the excavation to produce the estimated volume.

The Rock Quarry is greater than 0.25 miles from any known spotted owl activity center. Seasonal restrictions on blasting would be in place from March 1st to July 15th to avoid potential disturbance to spotted owls.

Temporary Roads

Temporary roads have been identified to facilitate harvest activities. All action alternatives include a total of approximately 25,500 feet of temporary roads as needed to access landings in Units 2, 5, 6, 8, 10,15, 20, 21, 30, 32, 35,36, 37, 39, 43, 45, 46, 52, 55, 60, 62, 64, and 70. See Figures 12-25 for segment lengths and logging system related to each unit. These roads would be located on stable, gently rolling terrain, where impacts to soils and streams are unlikely. The location of these temporary roads facilitate the use of yarding systems that can protect resources by minimizing soils displacement and reducing impacts to leave trees within the units. Temporary roads would be decommissioned after completion of logging operations. (See Chapter 2 - Mitigation Measures.).

Mitigation Measures and Design Measures Common to All Action Alternatives

Council of Environment Quality (CEQ) Regulations (§ 1508.20) defines Mitigation as:
• Avoiding the impact altogether by not taking a certain action or certain parts of an action.
• Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
• Rectifying the impacts by repairing, rehabilitating, or restoring the affected environment.
• Reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action.
• Compensating for the impact by replacing or providing substitute resources or environments.

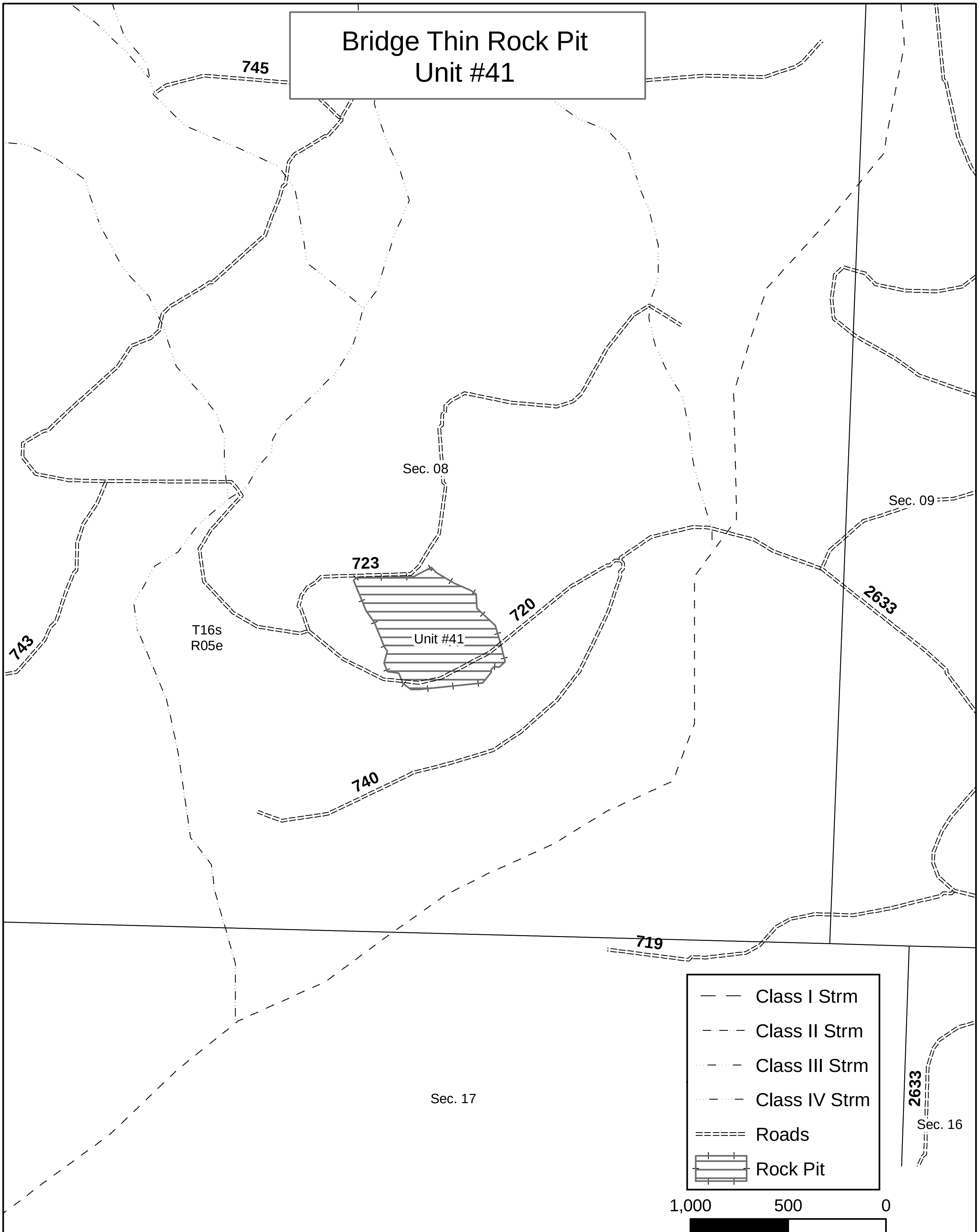


Figure 11. Mill Creek Rock Quarry location map.

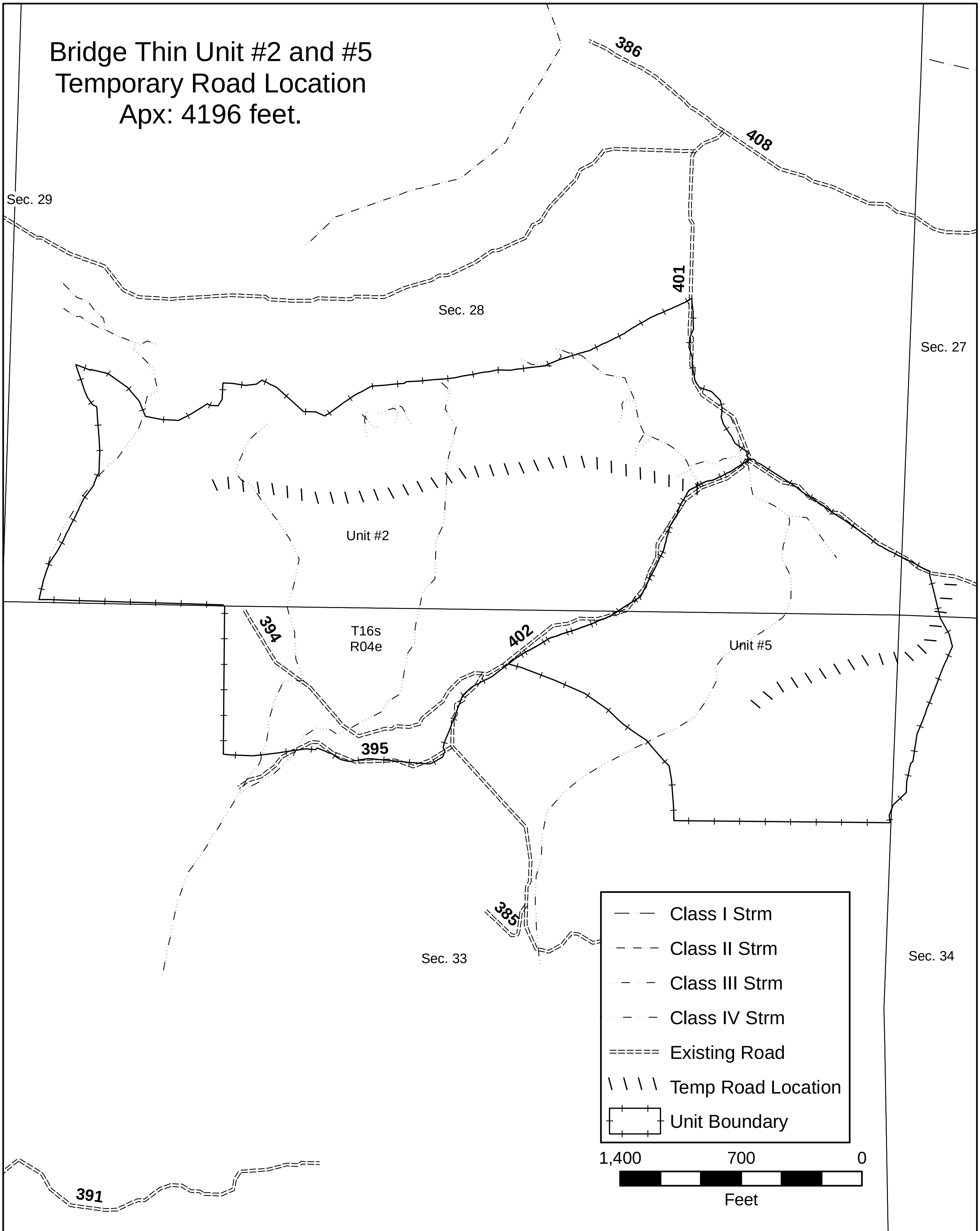


Figure 12. Temporary Roads - Units 2 and 5.

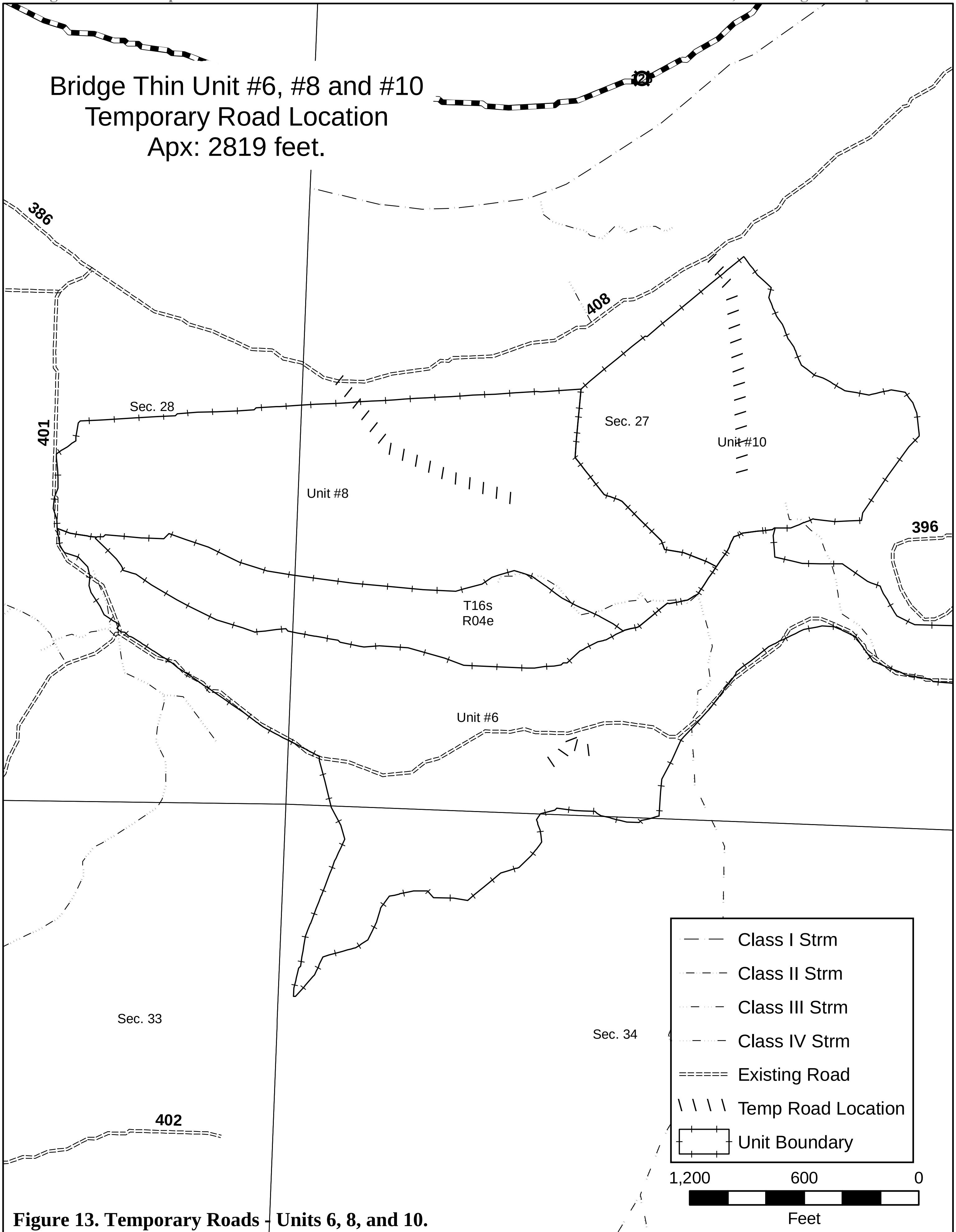


Figure 13. Temporary Roads - Units 6, 8, and 10.

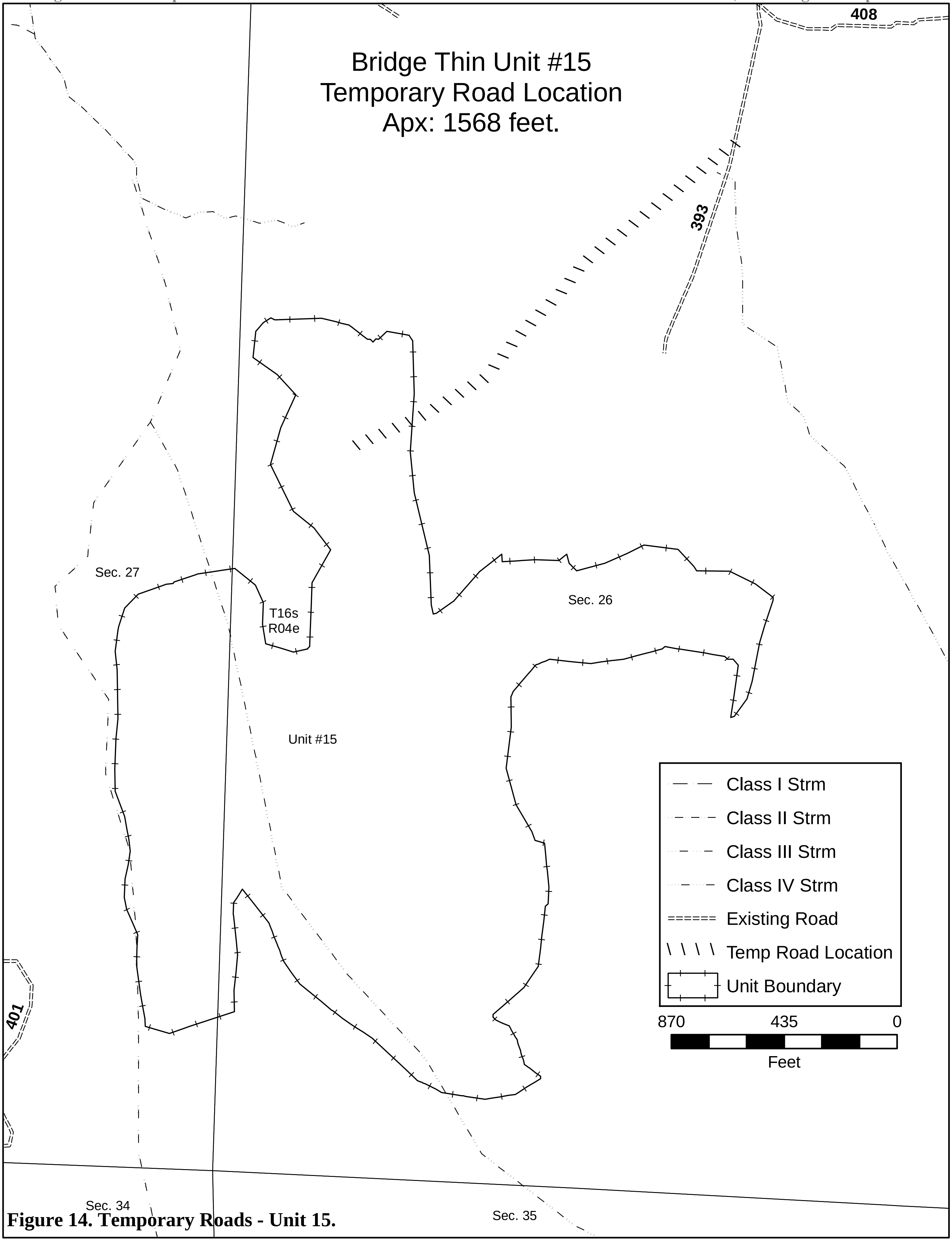


Figure 14. Temporary Roads - Unit 15.

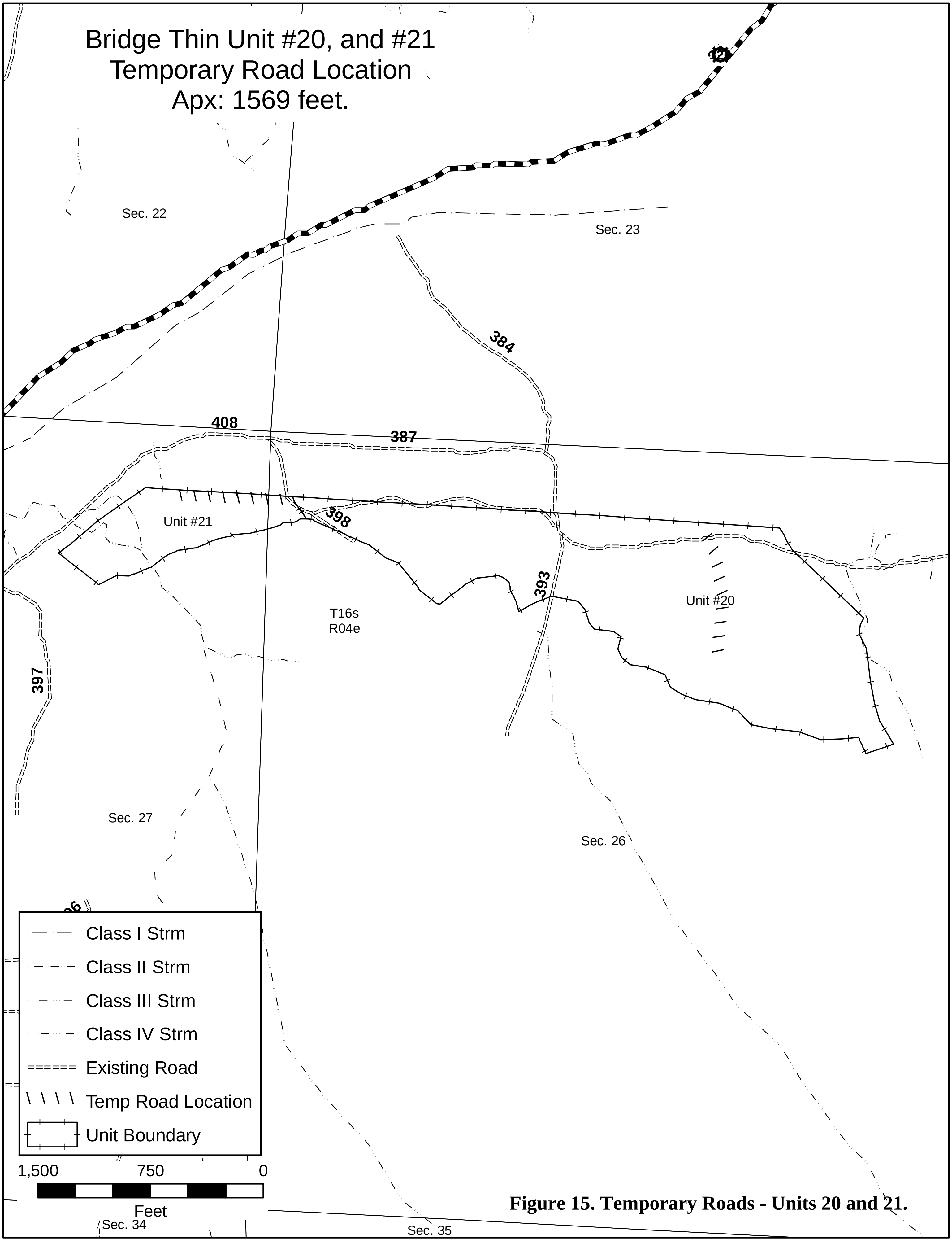


Figure 15. Temporary Roads - Units 20 and 21.

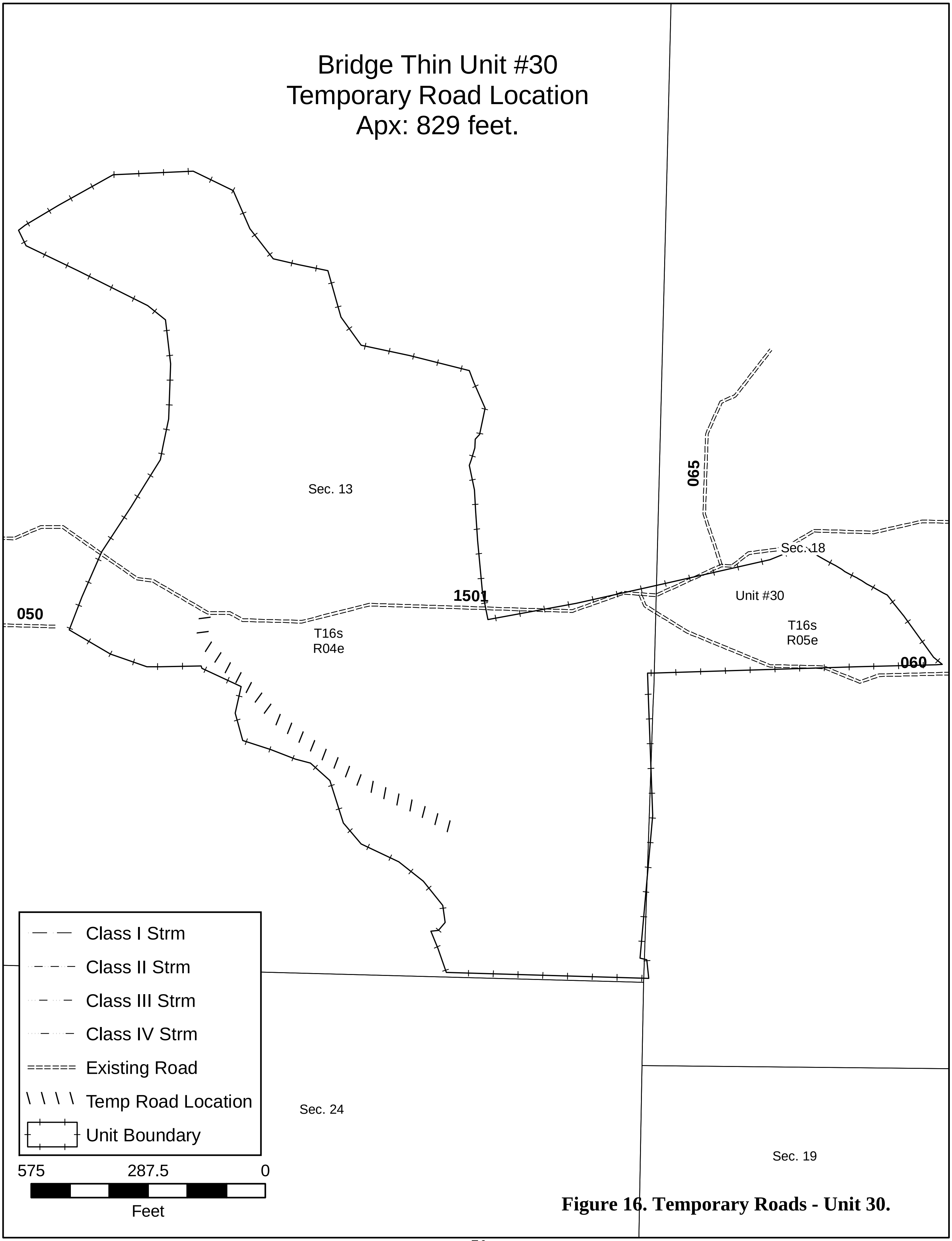


Figure 16. Temporary Roads - Unit 30.

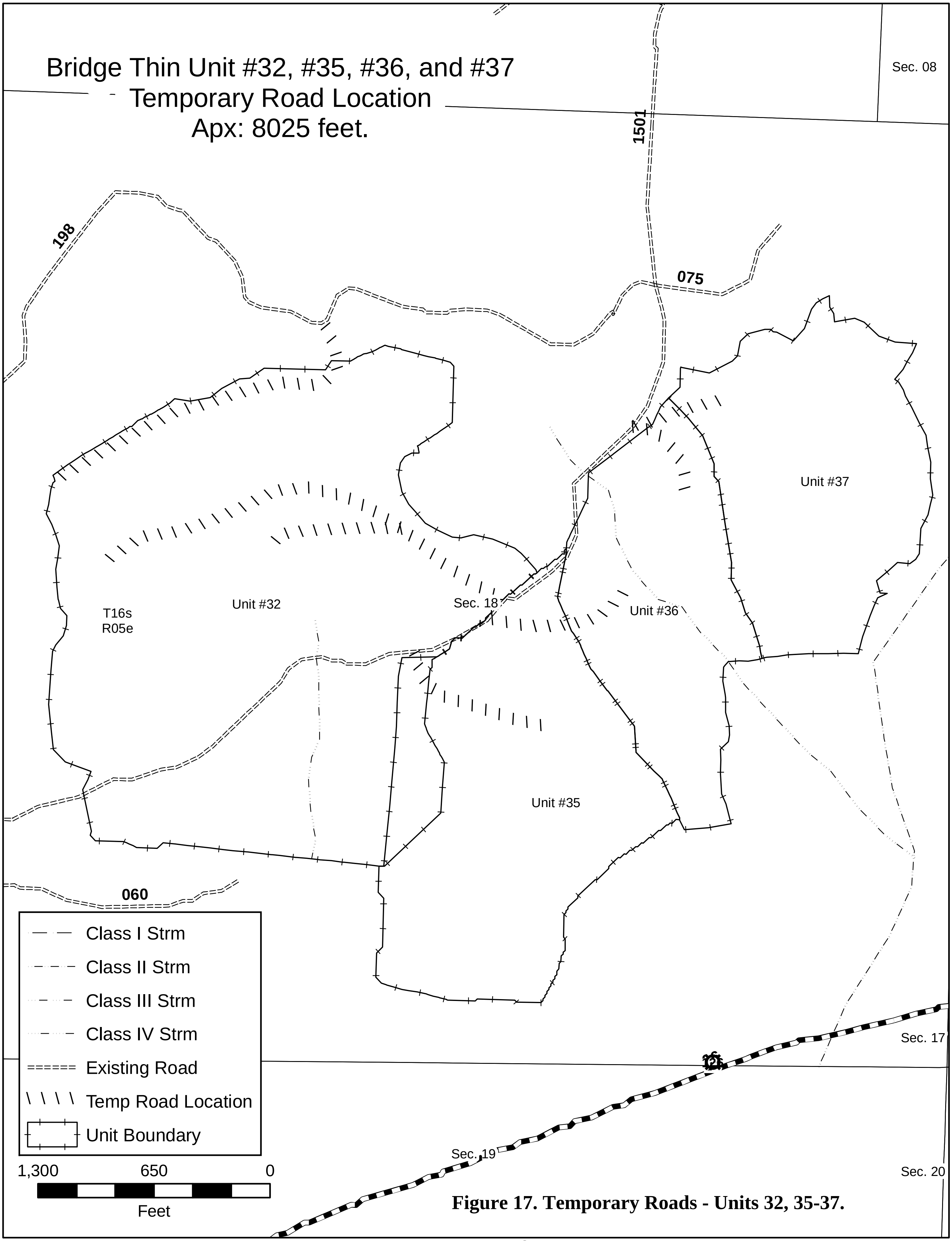


Figure 17. Temporary Roads - Units 32, 35-37.

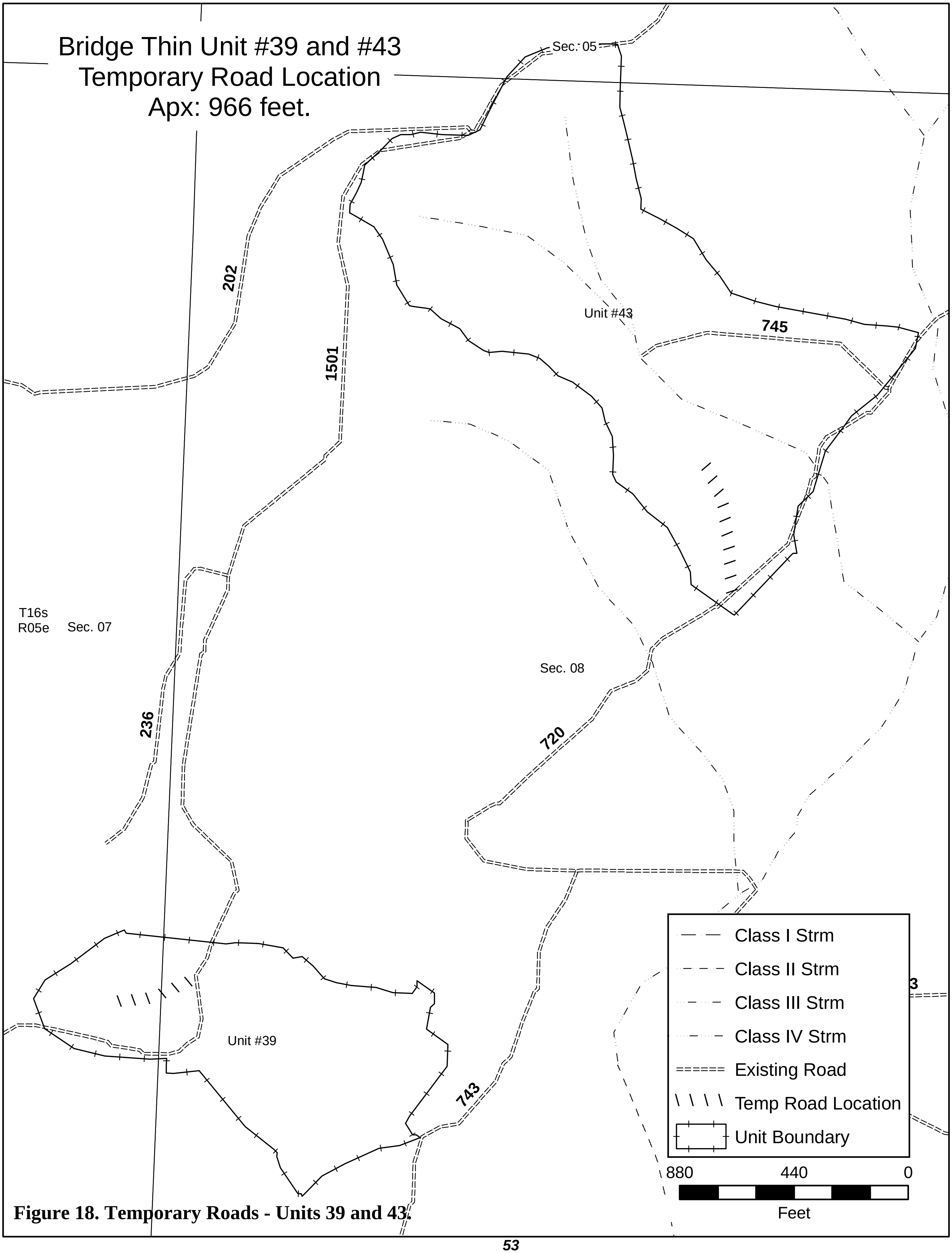


Figure 18. Temporary Roads - Units 39 and 43.

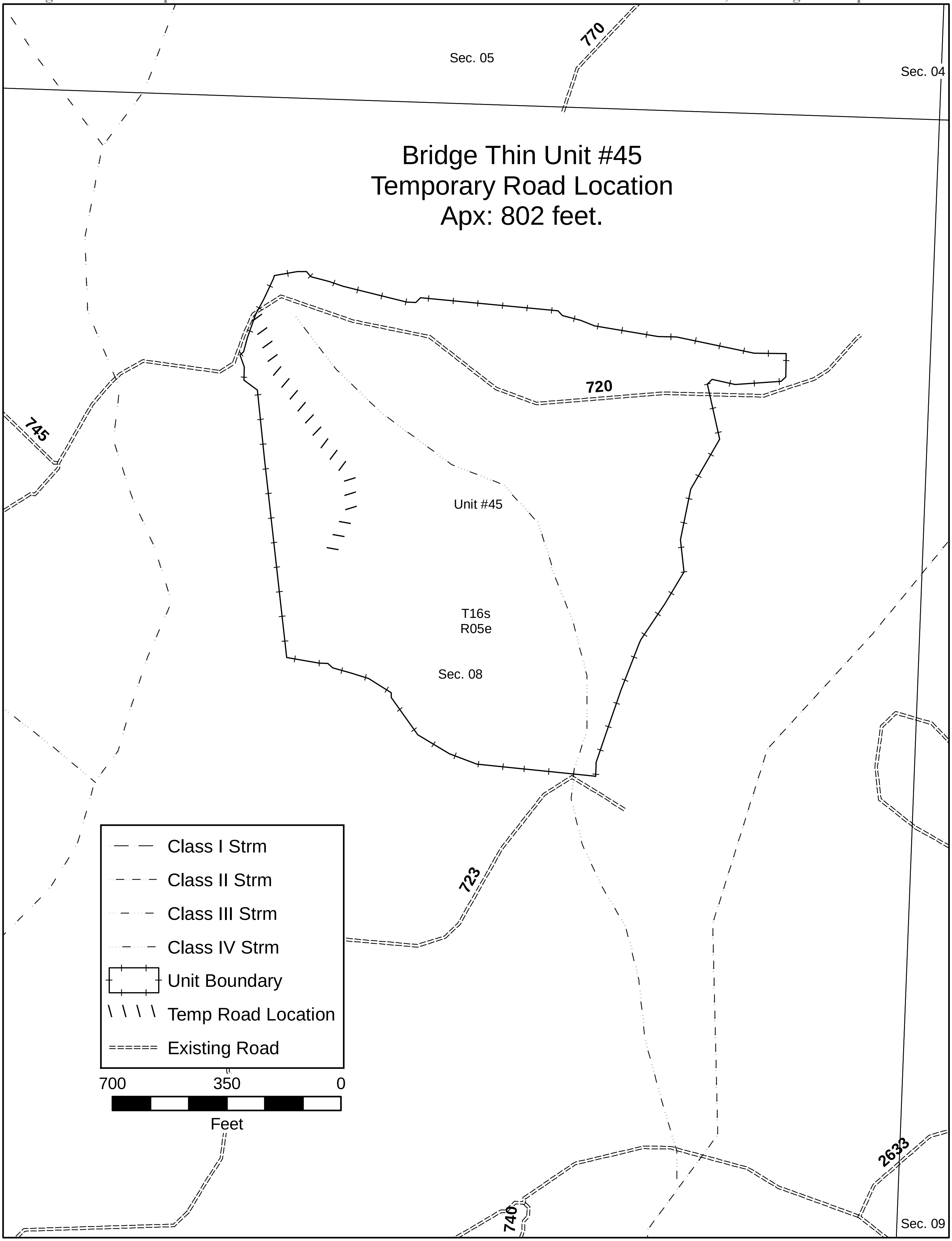


Figure 19. Temporary Roads - Unit 45.

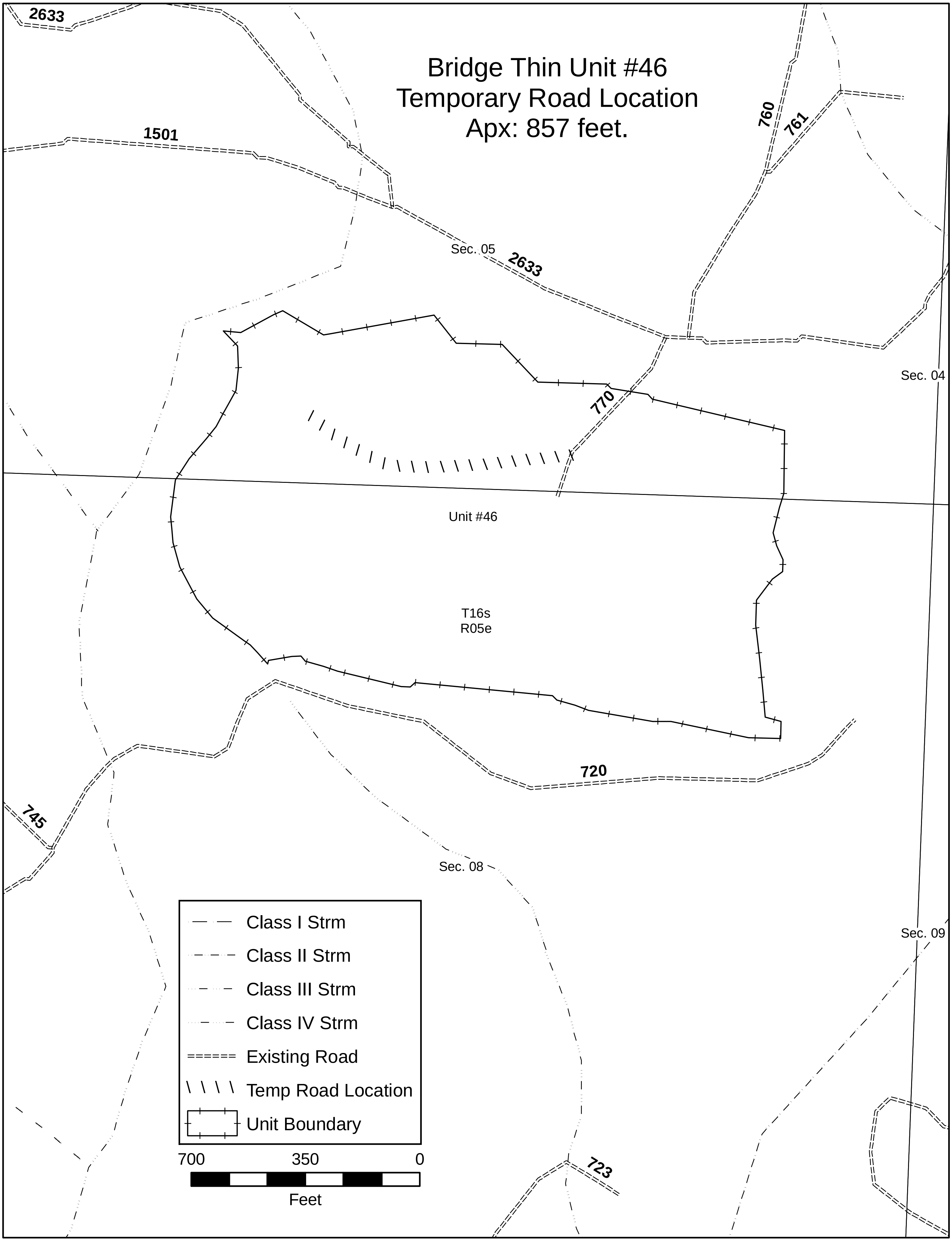


Figure 20. Temporary Roads - Unit 46.

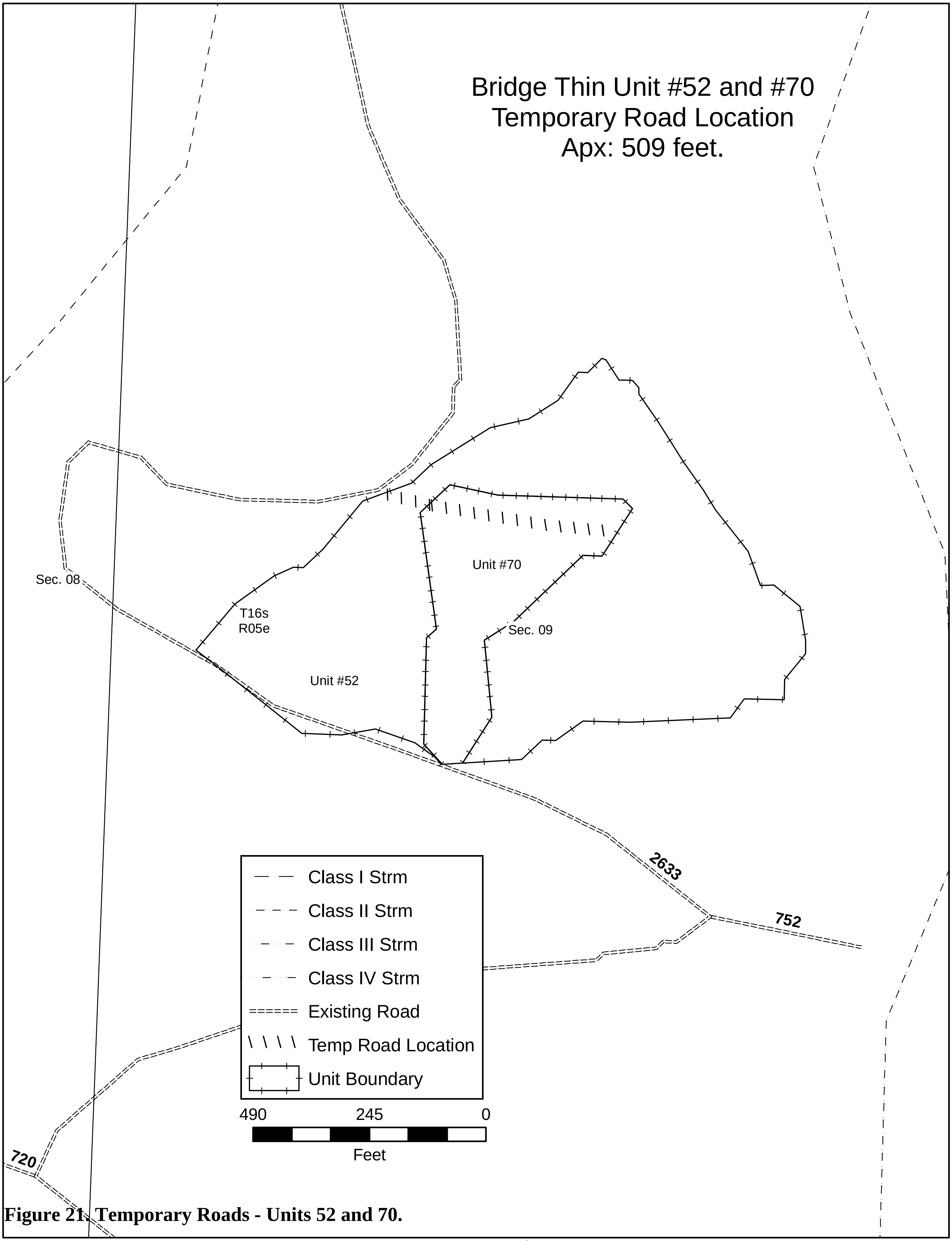


Figure 21. Temporary Roads - Units 52 and 70.

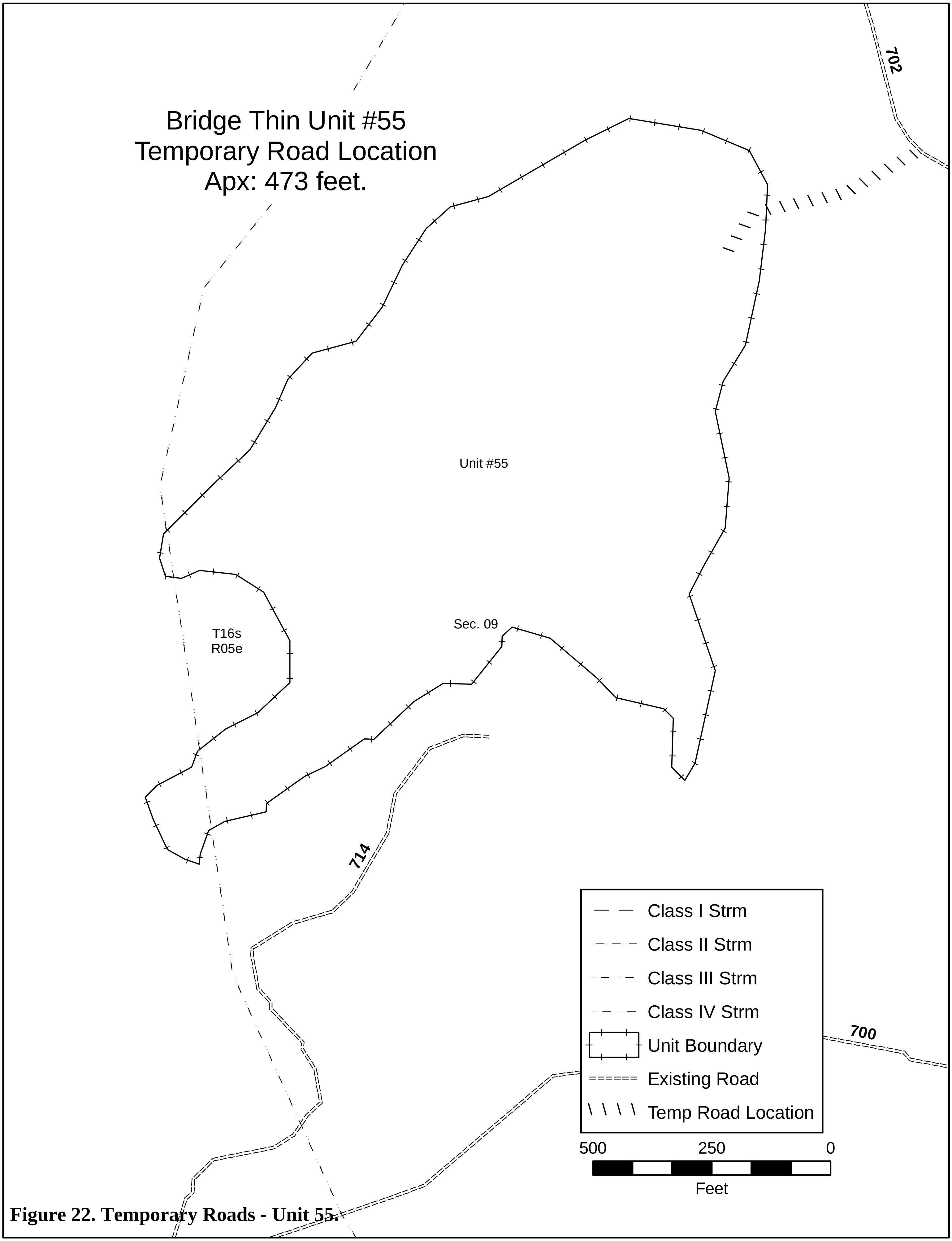


Figure 22. Temporary Roads - Unit 55.

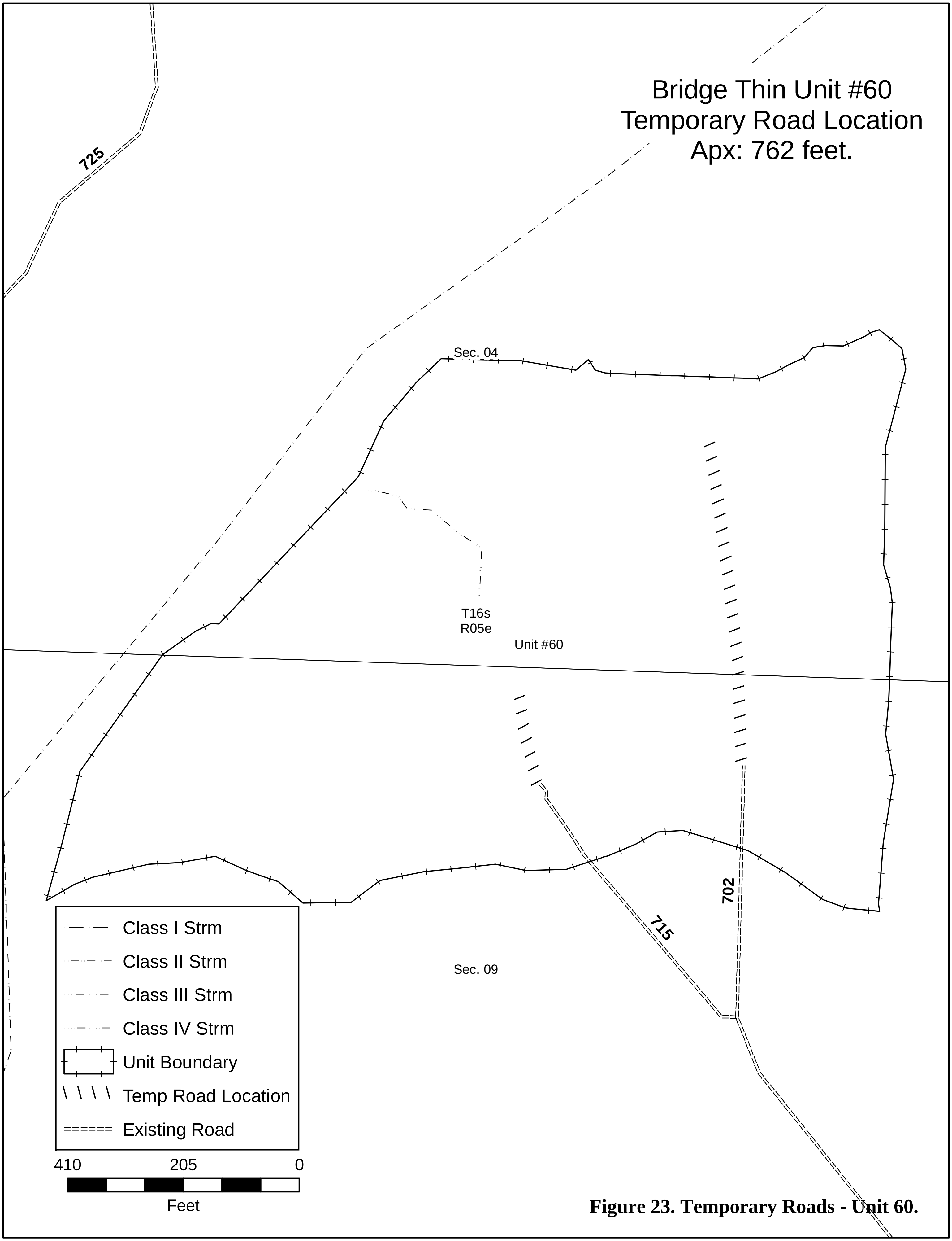


Figure 23. Temporary Roads - Unit 60.

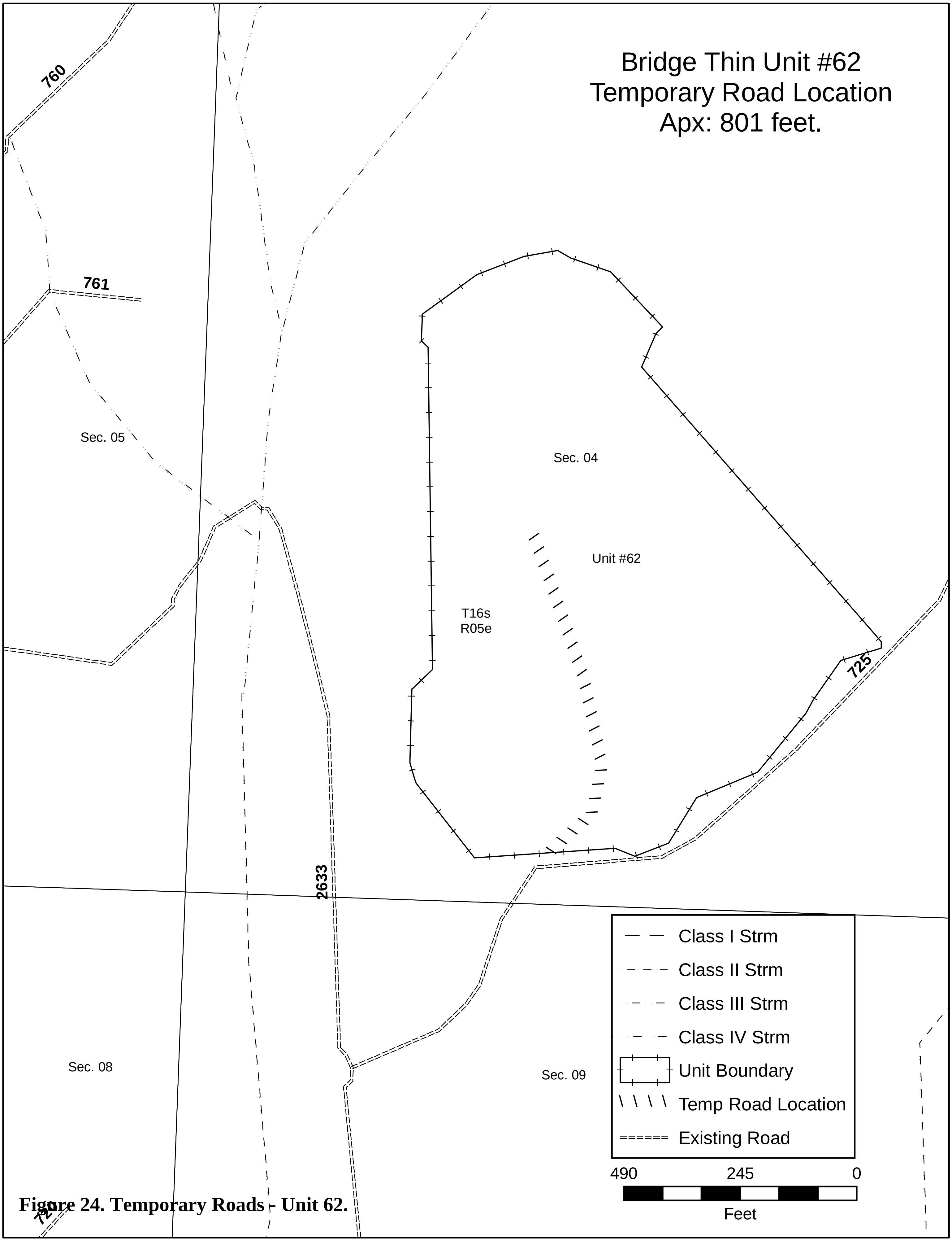


Figure 24. Temporary Roads - Unit 62.

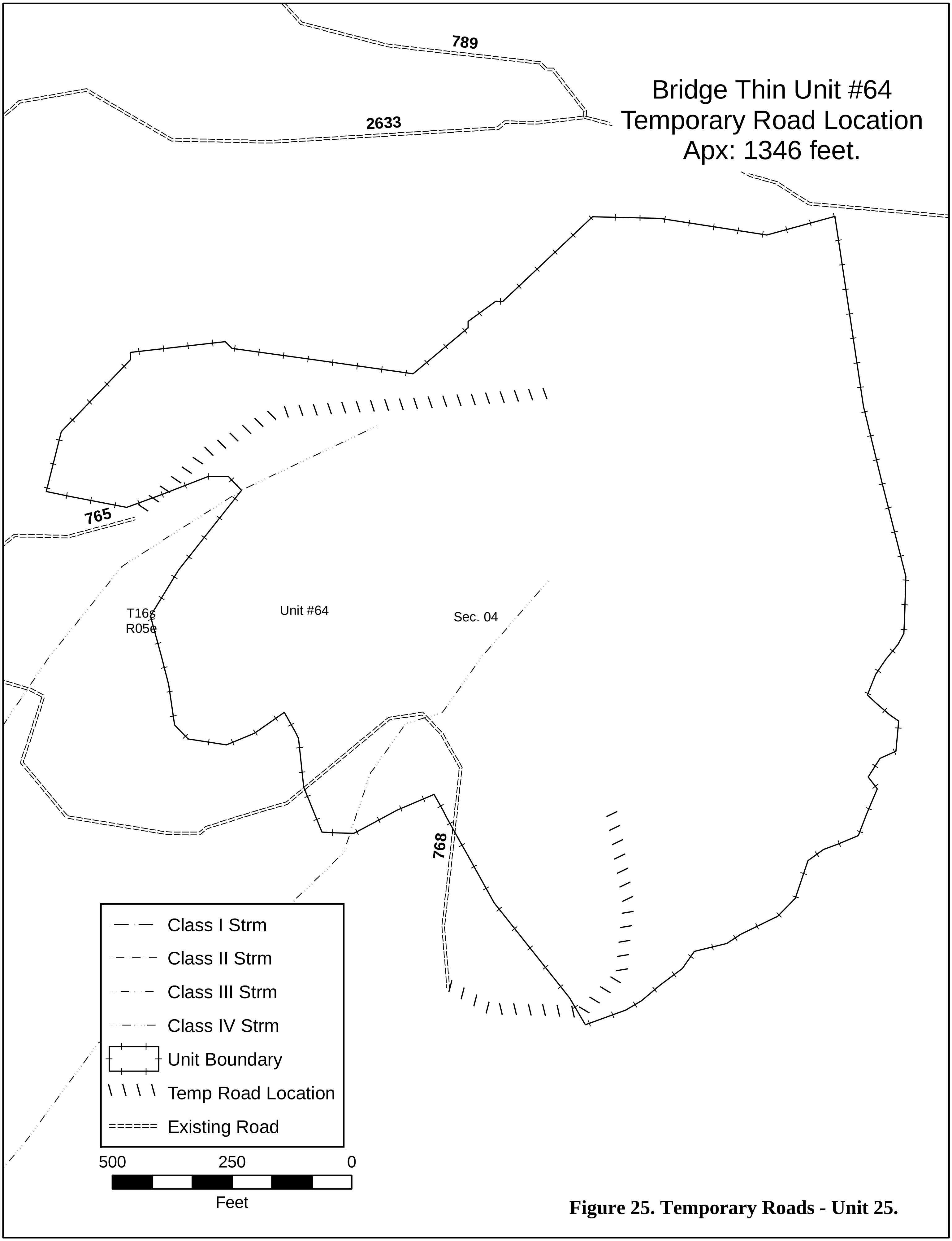


Figure 25. Temporary Roads - Unit 25.

Design measures are also specifically described in this section to provide resource protections that ensure implementation activities remain consistent with Willamette Forest Plan Standards and Guidelines. Mitigation measures and design measures would be implemented through project design and layout, contract specifications, contract administration, and following monitoring activities performed by Forest Service officers.

Silviculture

1. Plant as necessary to augment natural regeneration within gaps to ensure regional stocking levels are met. Plant with species that are not susceptible to the disease, when the gap is the result of root rot. Under-represented species should be planted to help increase diversity.

Soil, Watershed, and Fisheries Protection:

1. Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities (July 1st – August 15th). Best Management Practices (BMP's), including placement of sediment barriers, provision of flow bypass, and other applicable measures, would be included in project design as necessary to control off-site movement of sediment.
2. Native surfaced roads would be restricted for hauling during the winter rainy season between October 15 and May 31. The objectives are to maintain water quality and fish habitat.
3. Construction or maintenance of roads would not be done when soils are saturated or run-off occurs, to minimize erosion and sedimentation. A stable fill would be constructed across all streams when crossed by new temporary roads.
4. All haul roads would be maintained in stable condition. Winter hauling may be allowable when the road surface is either covered with a relatively continuous snow pack or frozen, when run-off from the road is unlikely. Watering the road surface would be used if roads become excessively dusty during the summer.
5. Ground-based equipment used for yarding, processing, fuel treatment, or other project activities would operate only when soils are relatively dry following the rainy season in the spring through the summer, or during the winter months when there is a continuous snow pack of at least eighteen inches deep or when soils are frozen to a depth of six inches or greater. Operations would be suspended before rainfall or precipitation results in off site movement of muddy water into drainage courses.
6. Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible.
7. Sedimentation and water quality are criteria in determining if ground based equipment can be operated on short slopes >30%. Soil displacement, a key factor in productivity also has an

increased probability on slopes >30% and should be identified as a factor to evaluate if ground-based logging equipment is allowed on steeper slopes.Ground-based equipment would be limited to slopes less than 30 percent for harvester/forwarder and conventional ground skidding operations. Short, isolated pitches up to 40 percent on otherwise suitable slopes may be approved after consultation with soil/watershed specialist determines that sediment transport to streams would not occur as a result. Adverse skidding conditions would be avoided through skid trail layout and use of alternative yarding systems.

8. Ground-based equipment used for yarding, processing, fuel treatment, or other project activities would not be permitted within 120 feet of the stream channel of Class 1, 2, and 3 (fish bearing and perennial non fish bearing streams) streams. Ground-based equipment would not be permitted within 50 feet of the stream channel in Class IV (seasonal, non-fish bearing) streams. In the remainder of the riparian reserve, ground-based equipment is permitted, but would be restricted to existing skid trails from previous entries. Alternative low disturbance ground-based equipment such as shovel yarding is also permitted in the remainder of the riparian reserve.
9. Regardless of unit harvest prescription, portions of harvest units that lie within riparian reserves would be managed to meet riparian objectives. Prescriptions elements designed to accomplish this are detailed on page 63.
10. Full suspension would be required when yarding over perennial stream channels. Where full suspension is not obtainable over intermittent streams, partial suspension would be required and yarding would be limited to when the stream is dry. Bump logs to protect the stream channel would be utilized as appropriate
11. Where cable yarding requires corridors through a riparian reserve, corridors would be laid out to result in the least number of trees cut. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would be felled into the channel and left on site.
12. All skid trails and landings would be water-barred to provide adequate drainage. Water bars location should occur where local terrain facilities effective drainage of the skid trail or landing. In general, water bars should be constructed every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be keyed-in to the cut bank and have a clear outlet on the down hill side. Where available, slash should be placed on skid trails and landings.
13. Skid trails in thinning harvest units with ground-based yarding would be scarified to a depth of 3-6 inches.
14. Skid trails in regeneration harvest units and all landings would be sub-soiled to a depth of 18-22 inches.
15. All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance would be seeded with non-invasive cereal grains such as winter wheat, and native perennial species.

16. Temporary roads would be decommissioned after completion of logging operations. Decommissioning of roads may include: berming the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, removal of placed rock, and re-vegetation of the road prism.
17. In units containing stream channels, all existing large down wood would be retained within riparian reserves to maintain aquatic objectives.
18. Water sources used by project operations would be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality.
19. Timber harvest and fuels treatments not aassociated with commercial harvest in riparian reserves would adhere to riparian reserve management measures listed below in Table 8.

Table 8. Riparian Reserve Management*.

	Timber Harvest – Thinning and Group Selection (Includes activity fuel treatment)	**Timber harvest - Savanna Restoration and Wildlife Habitat Enhancement (Includes activity fuel treatment)**	**Fuels Treatments (Not Associated with Commercial Harvest)**
<u>Previously Managed Plantation Stands</u> Units 1-7, 8, 10-15, 17-18, 20-21, 23-32, 34-40, 42-70, and 72	Class 1 and 2 - 60' NH, 50% canopy closure from 60’-300' Class 3 - 60' NH, 50% canopy closure from 60’-150' Class 4 - 30' NH Lakes - 300' NH Wetlands - 60' NH	Class 1 and 2 - 60' NH, 50% canopy closure from 60’-300' Class 3 - 60' NH, 50% canopy closure from 60’-150' Class 4 - 30' NH Lakes – 300' NH Wetlands – 60' - NH	Class 1 and 2 – 60' NT Class 3 and Class 4 – 30' NT Lakes - 60' NT Wetlands - 60' NT
<u>Previously Un-managed Stands</u> Units 80-89, 91, 95-103;, and 841	Class 1 and 2 - 300' NH Class 3 - 150' NH Class 4 - 30' NH Lakes - 300' NH Wetlands - 150' NH	Class 1 and 2 – 300' NH Class 3 – 60' NH, 50% canopy closure from 60’-150' Class 4 – 30' NH Lakes – 300' NH Wetlands – 150' NH	Class 1 and 2 – 60' NT Class 3 and Class 4 – 30' NT Lakes - 60' NT Wetlands - 60' NT

*: NH = No Harvest

The preceding list describes the Soil, water, and Fisheries mitigation measures that would be applied in the implementation of the proposed action Alternative B, or with the selection of Alternative C. These measures, or equivalent effective measures, would be incorporated into individual unit prescriptions by resource specialists as needed to mitigate potential undesirable effects.

Recreation:

1. Post an advance notice of operations at Blue River Reservoir boat ramp and King Castle Trailhead.

Wildlife:

1. A minimum post treatment canopy closure of 40 percent will be maintained in treatment units within the Critical Habitat Unit (units 46-48,57, and 60-66).
2. Snags would be retained when not a safety concern to support northern spotted owl and other primary cavity excavators.
3. To secure a visual screen for big game, 50-foot no-harvest buffers would be left within harvest units along forest service roads 1501 and 2633.
4. To reduce potential disturbance to any nesting spotted owls in the area, seasonal restrictions for burning and blasting would be imposed on disturbance activities in Table 9.These restrictions may be lifted if surveys are conducted and non-nesting is verified for the year of operation.
5. Large woody material: At least 240 lineal feet per acre of decay class I and II material greater than 18" diameter and 20 feet in length would be retained within all harvest units. Where the preferred size of material is not available, 240 lineal feet per acre of the largest diameter leave trees would be retained.
6. Hazard trees that are felled within units would be left on site for coarse woody debris.
7. A seasonal operating restriction is required for the Cascade Elk Rifle season, which is typically the third week of October. All public vehicle traffic would be restricted on closed roads beginning the Friday before this week through the end of the following Friday.

Table 9. Seasonal Restrictions Design Measures to Protect Northern Spotted Owl.

Unit	Seasonal restriction for burning	Seasonal restriction blasting at Rock Quarry development
41	No	Yes, March 1 – July 15
60	Yes, March 1 – July 15	No

Sensitive Botanical Species:

1. A no-disturbance buffer would be placed around known occurrences of sensitive plant species. Sizes of buffers are listed in the Botanical BE in Appendix C. Broadcast burning would not be implemented within the no-disturbance buffer. Trees would be felled away from the no-disturbance buffer.

Special Habitat Areas:

1. A no-harvest buffer would be placed around special habitats listed in Table 23. Sizes of buffers are listed Appendix C. Trees would be felled away from the no-disturbance buffer.

Heritage Resources:

1. Heritage resources identified during project development were avoided through project design; however there remains the possibility that buried prehistoric or historic cultural resources are present in the activity units and could be uncovered during project activities. If cultural resources are encountered during the course of this project, earth-disturbing activities in the vicinity of the find should be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. The appropriate timber sale contract provision would be included to provide for notification of the FS and protection of heritage resources.

Other Design Measures

Wildlife:

1. Minimize damage to existing adjacent trees and vegetation when falling and yarding hazard trees along the haul-route, especially the large diameter trees and snags retained.
2. If Threatened, Endangered, or Sensitive (TES) wildlife species are found in future field work or during activities associated with this project, and potential for adverse effects exists, project modifications would be pursued and would be implemented. All contracts will include provisions to provide required protection measures in the event of TES species discovery.
3. The wildlife biologist shall be notified of any changes made to this project that would alter the need for seasonal restrictions, resulting in either waiving or applying additional restrictions. Examples include changes in locations of helicopter landings, additional helicopter use, or blasting.
4. Implement planned road closures as soon as possible after forest products removal operations are completed to benefit wildlife species needing seclusion.

Invasive Plants Control:

1. All off-road equipment would cleaned to remove all dirt and debris prior to entering National Forest System lands and when moving from infested to non-infested areas within the project area. Cleaning methods can utilize compressed, high pressure water, or other specified methods.
2. Equipment should work in non-infested areas and then move to infested areas (USFS would provide map).
3. Pre and post harvest survey and control of Invasive Plants would be applied to all harvest units and associated roads in the planning area.
4. Clean fill (soil or rock free of slash and debris) should be used for construction of temporary roads. Sources of rock and fill material needs to be free of Invasive Plants. Rock quarries that may be used would be surveyed for Invasive Plants prior to use. If Invasive Plants are found, they would be treated as necessary prior to use.

5. Disturbed areas (culverts, road shoulders, closed/obliterated roads, landings, skid trails) would be re-vegetated with weed-free native seed to compete with noxious weed seed. Weed-free mulch would be used if necessary.
6. Roads to be bermed or decommissioned would be treated for noxious and non-native weeds prior to blocking to harvest activities. All roads with disturbed soil would be planted with native plant material to prevent invasion by non-native species.
7. Bermed and decommissioned roads would be monitored for Invasive Plants for three years after the road treatment is completed. Identified weed populations would be treated.

Fuels Treatment:

1. In riparian reserves prescribed fire may be allowed to back through the buffer in order to reduce the amount of fireline constructed along the unit and riparian reserve boundaries.

Hydropower:

1. Prior to implementation, Eugene Water & Electric Board and Bonneville Power Administration would be notified of project activities in treatment areas adjacent to transmission lines.

Silviculture Prescriptions

Table 10. Stand Treatment Prescriptions.

Stand Treatment (Salvage not included)	% Maximum SDI*+	Post-Harvest % Canopy Closure**+	Alt. A Acres	Alt. B Acres	Alt. C Acres
Moderate Thinning	35-45%	50-65%	----	391	377
Heavy Thinning	17-34%	40-55%	----	1,368	1,260
Wildlife Thinning	13-17%	30-50%	----	190	180
Oak Thinning	17-24%	20-45%	----	33	33
Riparian Thinning	31-52%	50-55%	----	145	137
Group Select	----	----	----	29***	29***
Fuels Thinning++	----	----	----	142	142
Natural Fuels Underburning++				51	49
Total Acreage	----	----	----	**2,449**	**2,271**

*SDI: Stand Density Index

**Riparian Reserves within all prescriptions maintain 50% minimum canopy closure.

***Not included in total acres because these acres are counted in the overall unit acres.

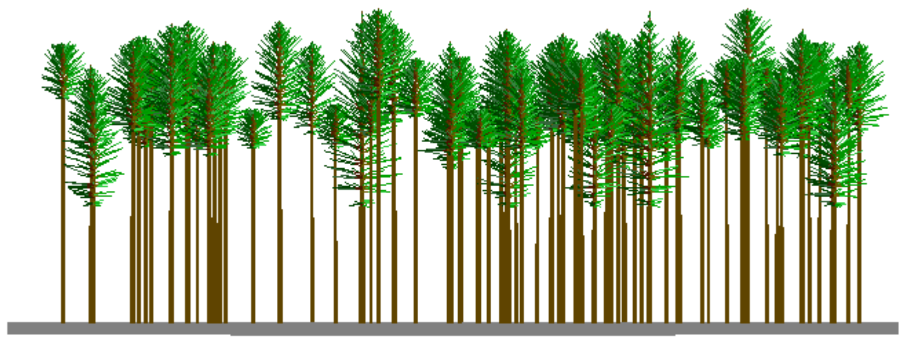
+Calculated on trees >= 7” dbh

++ No significant change in SDI or canopy closure due to removal of ladder fuels and brush <7” dbh

Current Stand Conditions

Previously-managed Plantations

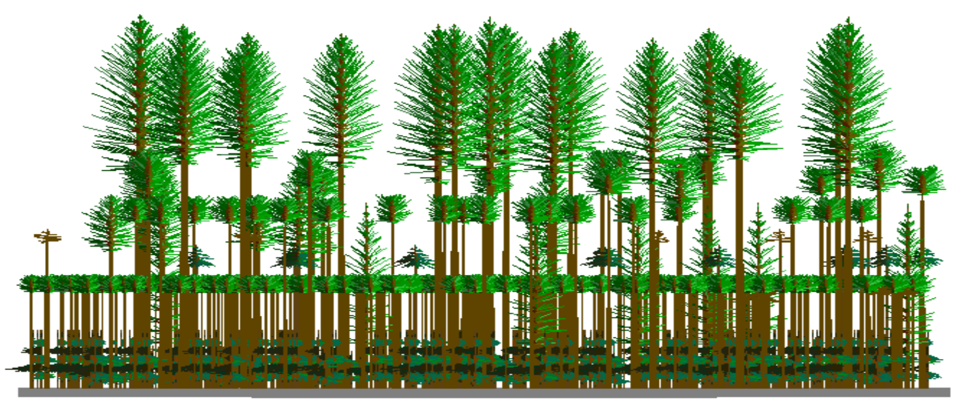
These stands range between 40-80 years old, and are the result of previous clear-cut harvesting. Stands in the 35-45 year age class are the most common age class in the project area. They are predominantly comprised of Douglas fir trees at moderate to high density stocking levels. Root rot exists in scattered areas and at low intensities. Units with a unit number less than 80 are previously managed plantations.



Previously-Managed Plantations

Fire Regenerated stands (estimated 80-120 years old)

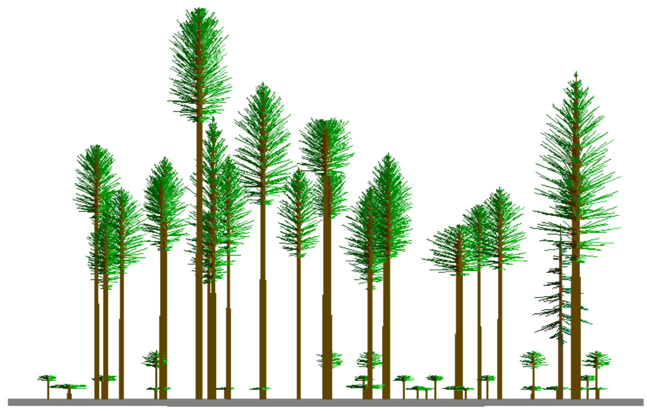
Some fire originated stands that are approximately 80-120 years old, have been identified for thinning. Thinning is proposed because current stocking levels are high. These stands were established after stand-replacing fires occurred in the late 1800's or early 1900's. The over-story is primarily Douglas fir with some western hemlock, and other various species. Scattered remnant old growth trees can also be found in most of the units. Selective harvest is evident in the stands with remnant stumps. Root rot pockets and signs of Douglas fir beetle have been known to exist in some of the stands contributing to the low and moderate levels of downed wood. Understory regeneration of shade tolerant species is starting to occur.



Fire Regenerated Stands

Oak Savanna Stands (estimated 80-120 years old)

The stands are remnant pockets of Oak Savanna that are being encroached upon by conifers. Shade resulting from the encroaching conifer species is hampering the regeneration of the Oregon White Oak (Quercus qarryana). The Oak Savanna habitat relies on fire to reduce competition from conifers, which provides the slower growing, more shade intolerant oak better opportunities to propagate.



Oak Savanna Stands

Silviculture Descriptions

Thinning

Intermediate cuttings of stands used for the reduction of stand density or management of species composition are called thinning. The main objectives-is increasing the overall growth potential of the residual trees while removing trees that would ultimately die from suppression. The thinning can be applied throughout a range of densities. A very light or salvage thinning confines removals to overtopped or suppressed trees where the canopy remains unbroken or only slightly broken. In contrast, a heavier thinning removes additional and higher crown classes opening the canopy to accelerate growth and crown expansion of the remaining trees. The remaining trees also develop into a healthier and more stable stand over time.

Group Select

This prescription would provide for gaps in the stands to increase diversity and forage. Group selects would be randomly placed unless a root rot pocket is identified. If a root rot pocket is identified, a 50’ area surrounding root rot pockets would be cleared, resulting in the group select Group selects would be small holes approximately an acre in size, except in riparian areas, where they would not exceed 0.5 acres. In the case of a root rot pocket, gaps created by the removal of root rot pockets would not exceed 5 acres in size, and this is expected to be infrequent. All but the largest trees (4 per acre of the largest size class for the pocket) are to be removed. Follow-up planting with species that are non-susceptible to the species of root disease may occur in root rot pockets. Large downed wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations. Burning and site preparation for planting may occur if necessary, depending on post logging slash load and needed slash components of early seral habitat.

Silviculture Prescriptions

Silvicultural treatments prescribed for the selected units include moderate thinning, heavy thinning, wildlife thinning, oak thinning, riparian thinning, and fuels thinning. This combination of treatments are prescribed by the IDT team in order to meet the various resources objectives derived from Forest Plan and project-level management direction, as well as the site specific conditions of the project area.

Stand Density Index. The stand treatments developed for the Bridge Thin project units are based on the Stand Density Index (SDI), which is a relative measure of the stand's density with a maximum SDI that varies for each tree species. SDI is based on a percentage of $SDI^{max,}$ which is the maximum stem density a stand can support. At approximately 50% maximum SDI, maximum stand production occurs and individual tree vigor would begin to decline (Long, 1985). Thus, lower levels of SDI should be maintained in order to meet stand objectives, like growth for sustainable timber and mean tree growth for various wildlife habitat objectives.

Treatments would maintain or improve overall stand growth and vigor by reducing competition for limiting resources, like light, water, and soil nutrients. Thinning would also increase individual tree stability making them more resistant to wind-throw as they mature. Trees would also be more resistant to insect infestations and disease. Understory shrubs and other vegetation would become established, or expand beyond areas where they currently exist into the openings created. Some natural regeneration of trees would also occur. Residual trees would respond over time with increased diameter growth and crown expansion. Consequently, another commercial thinning would likely be necessary in approximately 15 to 20 years when the maximum SDI levels again exceed 50%.

Moderate Thinning

The moderate thinning prescription (Rx) is proposed for the stands where exams have shown less than 200 trees per acre that are seven inches and greater in diameter at breast height (dbh). Units that would not be economically viable or could pose a safety concern were assigned Heavy Thinning prescriptions. Alternative B has 391 acres of Moderate Thin identified in Table 2. Alternative C has 377 acres of Moderate Thin identified in Table 5. The stands would be thinned to maintain 50-65% canopy closure and a post-treatment SDI of 35-45% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The goal is to increase growth and vigor of remaining trees, with emphasis placed on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease. Thinning the younger stands would also increase individual tree stability making them more resistant to wind-throw as they mature. Decreasing the tree density would also reduce fire susceptibility.

Moderate Thin before treatment **Moderate Thin after treatment**

Heavy Thinning

The heavy thinning prescription is proposed for the stands where exams have shown more than 200 trees per acre that are seven inches and greater in diameter at breast height. Alternative B has 1,368 acres of Heavy Thinning identified in Table 2. Alternative C has 1,260 acres of Heavy Thinning identified in Table 5. The stands would be thinned to maintain 40-55% canopy closure and a post-treatment SDI of 17-34% of SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The goal is to increase overall growth and vigor of the remaining trees and reduce the future mortality and susceptibility to insects, disease, fire, and wind. Emphasis would be on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity by opening the canopy to allow for in-growth of seedlings and development of some understory shrubs. Large wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations. Thinning the younger stands would also increase individual tree stability making them more resistant to wind-throw as they mature.

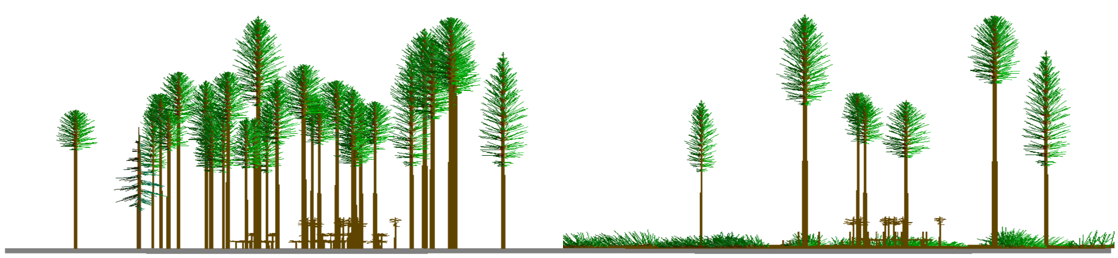
Heavy Thin before treatment **Heavy Thin after treatment**

Wildlife Thinning

The wildlife thinning prescription is proposed for the stands where the emphasis is to create forage habitat for big game species. Alternative B has 190 acres of Wildlife Thinning identified in Table 2. Alternative C has 180 acres of Wildlife Thinning identified in Table 5. The stands would be thinned to maintain 30-50% canopy closure and a post-treatment SDI of 13-17% of SDI^{max}. Trees removed would primarily be the smaller trees in the stands. The goal is to create an open stand with widely spaced trees to stimulate growth of grasses, forbs, and brush species. In addition, the wide spacing and residual larger trees would increase the overall growth and vigor of the remaining trees and reduce the future mortality and susceptibility to insects, disease, fire, and wind. Emphasis would be on maintaining non-Douglas fir species. The wildlife thinning treatments would also produce increased vegetative diversity. This vegetative diversity would increase because opening the canopy would allow for in-growth of seedlings and understory shrubs, resulting in the development of early seral habitat. Large wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations.

Oak Thinning

The oak thinning prescription is proposed for the stands where restoration of open oak savanna is desired. Both action alternatives include 30 acres of Oak Thinning and can be identified in Tables 2 and 5. The stands would be thinned to maintain 20-45% canopy closure and a post-treatment SDI of 17-24% of SDI^{max}. The goal is to remove trees that have encroached on the oak savanna habitat which has impacted regeneration of Oregon white oak (*Quercus garrayna*). The wide spacing and residual larger trees would increase the overall growth and vigor of the remaining trees and reduce the future mortality and susceptibility to insects, disease, fire, and wind. Emphasis would be on maintaining Oregon white oak with Douglas fir as the primary cut tree. A follow-up broadcast burn would be applied to remove duff and slash. Cutting of trees and the follow-up underburn would help to promote oak regeneration. Snags would be maintained on site if not a hazard to logging operations.

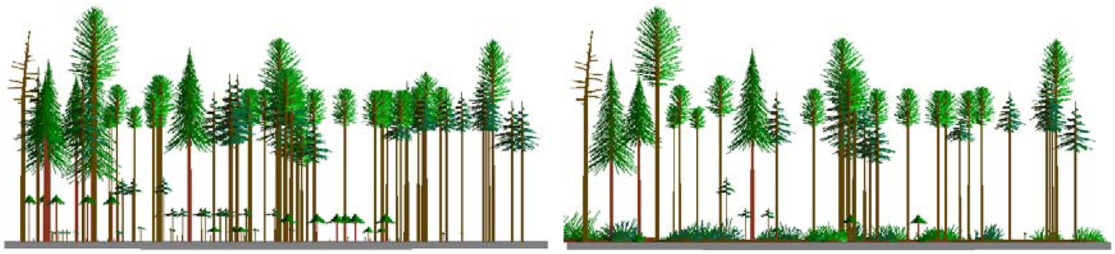


Oak Thin before treatment **Oak Thin after treatment**

Riparian Thinning

The riparian thinning prescription is proposed in riparian areas to maintain an average of 50% canopy cover. Alternative B has 145 acres of Riparian Thinning identified in Table 2. Alternative C has 137 acres of Riparian Thinning identified in Table 5. The stands would have a post-treatment SDI of 31-52% of SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The goal is to increase overall growth and vigor of the remaining trees and reduce the future mortality and susceptibility to insects, disease, fire, and wind. Emphasis would be on maintaining non-Douglas fir species. The creation of large woody debris for in-stream process would be accelerated by riparian thinning, which provides more growing space for the residual stand creation.

Large wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations.



Riparian Thin before treatment **Riparian Thin after treatment**

Fuels Thin

The fuels thinning prescription is proposed in units where no commercial product is to be produced. Alternatives B and C have 142 acres of Fuels Thins identified in Tables 2 and 5. The stands post-treatment canopy closure and SDI would have minimal, if any change due to the removal of sub-merchantable material. Trees removed would be the smaller diameter Douglas fir trees in the stands. The goal is to improve the stands fire resiliency by removing ladder and ground fuels, and to provide for firefighter safety by decreasing flame length. In addition the overall growth and vigor of the remaining trees would increase and the prescription would reduce the future mortality and susceptibility to insects, disease, wildfire, and wind. Large wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations.

Fuels thin before treatment **Fuels thin after treatment**

Group Select

This prescription would provide for gaps in the stands to increase diversity and forage. Both action alternatives include approximately 29 acres of Group Selects. Group selects would be placed in units 2, 3, 8, 10, 20, 40, 42, 43, 44, 45, 46, and 68. Group selects would be small holes approximately an acre in size, with the exception being in riparian areas where gaps would be no larger that 0.5 acres. All but the largest trees (4 per acre of the largest size class for the pocket) would be removed in these gaps. Only one gap would be created for each 20 acres within a stand. Group selects would be randomly placed, unless a root rot pocket is identified. A 50' area surrounding root rot pockets would be cleared, resulting in the group select. Openings created by the removal of root rot pockets would not exceed 5 acres in size, and this is expected to be infrequent. Within the stand, another prescription (i.e. wildlife thin) would be applied to the area outside the group select. In the case of a root rot pocket, the group select may be larger than 1-2 acres depending on the size of the root rot pocket. Follow-up planting with species that are non-susceptible to the species of root disease may occur in root rot pockets. Large downed wood on the forest floor would be maintained or increased. Snags would be maintained on site, if not a hazard to logging operations.

Stand before wildlife & group selection **Stand after wildlife & group selection**

Comparison of Alternatives

This section provides a summary of actions and the connected actions described above for each alternative.

Table 11. Comparison of Alternatives by Activity.

Management Activity	Units of Measure	Alt. A No Action	Alt. B	Alt. C
Harvest Treatments				
Moderate Thinning	Acres	0	391	377
Heavy Thinning	Acres	0	1,368	1,260
Wildlife Thinning	Acres	0	190	180
Oak Thinning	Acres	0	30	30
Riparian Thinning	Acres	0	145	137
Group Select	Acres	0	29 (acres not in total-	29 (acres not in total-

Management Activity	Units of Measure	Alt. A No Action	Alt. B	Alt. C
			encompassed in other prescriptions)	encompassed in other prescriptions)
Total Acres of Stands with Timber Harvest	Acres	0	2,256	2,079
Gross Estimates of Timber Output	(MBF/ CCF)	0/ 0	47,758/ 90,391	44,187/ 83,618
Total Acres of Timber Harvest in Stands >/= 80 years old (not in Oak Thinning)	Acres	0	140	0
Logging System				
Ground-based	Acres	0	770	760
Skyline	Acres	0	960	830
Helicopter	Acres	0	520	500
Fuels Treatment				
Fuel Thins	Acres	0	142	142
Natural Fuels Underburn	Acres	0	51	49
Grappel Pile and Burn	Acres	0	397	397
Hand Pile and Burn	Acres	0	264	264
Underburn	Acres	0	1,266	1,133
Roads				
Road Maintenance	Miles	0	34.2	33.7
Open Roads Closed by Gates or Berms	Miles	0	0.2	0.2
Total Road Decommissioning	Miles	0	0.3	0.3
Temporary Roads	Feet	0	25,552	25,552

Comparison of Alternatives by Significant Issues

The following tables summarize detailed analysis presented in Chapter 3 on the effects of the alternatives.

Table 12. Comparison of Alternatives – Aquatics/Riparian Resources.

Issue Measurement	Units of Measure	Alternative A (no action)	Alternative B	Alternative C
Issue #1:Water Quality/Aquatics Resources				
Indicator #1: ***Increase in Stream Water Temperatures***	**Degrees Celsius**	0.5° to 0.6°	0° from existing condition	0° from existing condition
Indicator #2: ***Changes in risk of altered peak flows***	**Aggregate Recovery Percentage (ARP)**	88.31%	88.26%	88.26%
Indicator #3: ***Sediment Yield During Project (Road Origin Sediment)***	**Sediment Cubic yards**	247	273	271
Indicator #3: ***Sediment Yield After Project (Road Origin Sediment)***	**Sediment Cubic yards**	247	230	227
Indicator #4: ***The amount of riparian area receiving thinning treatment.***	**Acres treated/ Percentage of Riparian in the project area**	0/ 0%	145/ 4.7%	137/ 4.2%
Issue #2: Threatened Northern Spotted Owl				
Indicator #1: ***Suitable Owl Habitat***	**Acres Downgraded***	0	0	0
Indicator #1: ***Suitable Owl Habitat***	**Acres Removed**	0	0	0
Indicator #2: ***Dispersal Owl Habitat***	**Acres Removed ** **	0	228	218

*: Units 101 and 103 would be treated with a fuels reduction (non-commercial harvest) that would maintain suitable habitat.

**: Oak savannah restoration and wildlife thinning would remove dispersal habitat.

Chapter 3. Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Chapter 2.

The cumulative effects discussed in this section include an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive, and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present, and reasonably foreseeable future actions. Individual effects of past actions are not listed or analyzed, and are not necessary to describe the cumulative effects of this proposal or the alternatives. (CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005.)

Forest and Stand Structure

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Forest and Stand Structure includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Forest and Structure

The Bridge Thin Analysis Area (Figure 1) consists of 20,657 acres within the McKenzie River/Elk Creek 6th field watershed located on the McKenzie River Ranger District. Timber harvesting has been a dominant disturbance on the forested landscape in the 20th century impacting approximately 3,711 acres (31%) of the 11,961 acres managed by the Forest Service within the analysis area. Prescribed burning, wildfires, windthrow, and insect and disease have had much less affect during that time. In addition, private land within the project area has had extensive harvest within the past 50 years. There is no reliable source of vegetative age data for private industrial forest lands in the project area, but based on GIS analysis and knowledge of the area, it is estimated that approximately 75%, or 6,400 acres, of the private ownership in the project area is industrial forest land. It is assumed that these lands are being managed on a 40-50 year rotation, so in the past 50 years approximately 6,400 acres of private land in the project area has been harvested. Management of private industrial forest lands is expected to remain consistent for the reasonably foreseeable future.

The following table provides a summary of timber harvest by type and decade. Regeneration harvest activities include clearcutting and shelterwood.

Table 13. Historic Harvest in the Bridge Thin Analysis Area.

Decade	Historic Management on Federal Land; Acres by Activity Category			
	Regeneration Harvest	*Commercial Thinning*	*Salvage*	*Pre-commercial Thinning*
1940s	710	0	0	0
1950s	69	0	0	0
1960s	664	0	0	0
1970s	395	18	34	267
1980s	478	249	28	284
1990s	532	282	216	312
2000-Present	0	21	15	224
Total	2,848	570	293	1,087

Approximately 2,848 acres of National Forest system land (31%) was modified with regeneration-type timber harvest, which is now in plantations 70 years old or less. Many of the existing plantations in the analysis area are now becoming ready for intermediate thinning treatments. Over the next decade younger plantations would continue to become both old enough and large enough for commercial thinning.

The project area consists of a mosaic of managed and natural forests with various stand ages and structure. The stands identified for harvest are primarily previously managed stands consisting of plantations from even aged harvest, with some older stands where selective harvest has occurred and fire regenerated natural stands also included. The current phase of structural development varies with the age of the stand, site conditions, and disturbance history. For the most part, the stands are entering stem exclusion (self-thinning) with reduced growth and limited regeneration. Gaps in the canopy created from self-thinning or disturbance from wind-throw and root rot are promoting regeneration of conifer species. The regeneration is primarily of shade tolerant species due to the small size of the gaps.

Natural disturbance from windthrow and disease has also provided various levels of snag and large down wood component that varies in the levels of decay. Most stands have some old remnant Douglas fir trees that have survived past fires and other natural disturbances. These forests have mostly Douglas fir and western hemlock over-stories with shade tolerant species in the understory when regeneration occurs. Past management in the older natural stands were primarily salvage logging.

The stands contain from 63 to 591 overstory trees per acre with average diameters of 15 inches dbh in the young managed stands and 27 inches dbh in the older stands with a site tree potential estimated to be 150 foot. Canopy closures of trees 7 inches or larger diameter breast height average 66% within the planning area. Stands have scattered root rot pockets of armillaria root disease (*Armillaria ostoyae*) and laminated root rot (*Phellinus weirii*), both of which are common on the McKenzie River Ranger District and are often associated with insects such as bark beetles.

Bridge Thin planning area stands exams occurred over several years and were completed in 2007. The data indicates that tree growth and vigor have been in decline over the years, and would continue to decline with future increases in stand size and stand density. For stands in the planning area the Stand Density Index (SDI) is relative to Douglas fir , the major species in the stands. Douglas fir has a maximum SDI of 595 before it reaches full site occupancy (Reineke, L.H. 1933). An SDI of 60% of the maximum SDI is often considered the lower limit of self thinning and would show reduced growth. To maximize overall growth a target range of 35-50% maximum SDI is desired. The stands proposed for harvest treatment average 60% maximum SDI with a range of 21% in the Oak Savanna units to 113% in the younger plantations.

Environmental Consequences—Forest and Structure

For the following analysis of environmental consequences, the current condition of the forest stands, including measures of SDI and stand development, was modeled using the Forest Vegetation Simulator (FVS) (USDA FS 2006 PNW model with Western Cascade variant).

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

No stand treatments would occur with implementation of Alternative A. Stands growth rates would continue to decline at current rates, and natural processes that affect tree vigor and cause changes in stand structure over time would continue. Tree mortality occurring within known root rot pockets would continue unabated. Populations of Douglas fir beetle would increase and decline in response to pockets of root rot mortality.

Many stands are overstocked; site resources are being fully utilized and inter-tree competition is intense. The effects of overstocking include decreased growth, increased rates of mortality and high risk for insect attack. High rates of mortality would increase fuel loading; this combined with understory ladder fuels puts these stands at high risk for a stand replacement wildfire. These conditions are not sustainable over time. Stand conditions that can favor the spread of insect and disease in proposed harvest units would continue unabated. Decline in underrepresented species, like sugar pine (*Pinus lambertiana)* and western redcedar (*Thuja plicata*), would continue.

Seral stage diversity within the stands would remain low. In the absence of treatments including timber harvest and underburning, species tolerant to regenerating and growing under thick canopies would dominant the site over time. High stocking density and canopy closure would continue to restrict regeneration of Douglas fir and sugar pine. The species composition in many stands would slowly shift from being dominated by species less tolerant of shade to more tolerant species like western hemlock.

The current lack of quality early seral habitat for wildlife species from butterflies to elk would persist. Encroachment would continue to reduce the oak savanna habitat.

There is no ongoing or reasonably foreseeable timber harvests planned on Forest Service lands in the Bridge Project area. As disussed previously, timber harvests on private lands in the project area are ongoing and expected to remain consistent for the reasonably foreseeable future.

Alternatives B and C — Direct and Indirect Effects

Moderate Thinning

Moderate thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Moderate Thinning prescription (Rx) is proposed for the stands where exams have shown less than 200 trees per acre that are seven inches and greater in diameter at breast height (dbh). Units that would not be economically viable or could pose a safety concern were assigned a Heavy Thinning Rx.

The following units have the moderate thinning Rx: 20,21,23,24,26,32,34,58,60,62, 64, 65,66,67,70, and 81 in alternative B and 21,23,24,26,32,34,58,60,62,64,65,66,67, and 70 in alternative C.

The stands would be thinned to maintain 50-65% canopy closure and a post-treatment Stand Density Intensity (SDI) of 35-45% the SDI^{max} (SDI^{max} is the maximum number trees that can exist in a stand relative to size and spacing [Long 1996]). Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease. Moderate thinning will result in variable density by having a range of residual spacing, natural holes in stands, unthinned areas, and yarding corridors breaking up continuity.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213) The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50’ would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Moderate thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The canopy closures would be opened up to 50-65%, also providing opportunity for the establishment new vegetation and shade intolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 10 to 15 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 81 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Heavy Thinning

Heavy thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Heavy Thinning Rx is proposed for the stands where exams have shown greater than 200 trees per acre that are seven inches and greater in diameter at breast height (dbh). Units with less than 200 seven inch and greater trees per acre that would not be economically viable or could pose a safety concern were also assigned a Heavy Thinning Rx.

The following units have the Heavy Thinning Rx: 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 18, 25, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 46, 47, 48, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 63, 69, 72, 82, 83, 841, 88, 91 in alternative B and 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 18, 25, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 46, 47, 48, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 63, 69, and 72 in alternative C.

The stands would be thinned to maintain 40-55% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-34% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Heavy thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 10 to 15 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 82, 83, 841, 88, and 91 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Wildlife Thinning

Wildlife thinning maintains or increases overall stand growth and vigor by highly reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Wildlife Thinning Rx is proposed for the stands which pose greater wildlife benefits for big game forage while maintaining an overstory of larger trees.

The following units have the Wildlife Thinning Rx: 40, 42, 43, 44, 45, 68, and 80 in alternative B and 40, 42, 43, 44, 45, and 68 in alternative C.

The stands would be thinned to maintain 30-50% canopy closure and a post-treatment Stand Density Intensity (SDI) of 13-17% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

The lower densities in residual stands would result in greater diameter growth making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Wildlife thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment of new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would increase structural diversity in treated stands and promote the future creation of large snags and down wood. To further stimulate the establishment of new vegetation fire treatments such as understory burning would occur.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 20-25 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 80 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Oak Thinning

The objective of oak thinning is to reduce the encroachment of conifer species on existing oak savanna. Reduced stand densities and conifer competition will promote the reestablishment of grasses and Oregon White Oak (*Quercus garrayna)* into their historic range. Oak thinning in a stand would result in wide spacing with an average residual spacing around 35 feet from the oak, which is "not tolerant of over-topping by Douglas fir and associated conifers" (USDA Forest Service Handbook 654). These stand conditions will benefit wildlife species that favor this more open habitat type.

Units 84 and 85 have the Oak Thinning Rx in alternative B and alternative C. The stands would be thinned to maintain 20-45% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-24% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to reduce densities and competition on the Oregon White Oak from encroaching conifer trees. Emphasis is on maintaining and promoting Oregon White Oak.

The residual stands lower densities would result in greater diameter growth making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed (WSU – Forest Health).

The oak thinning creates openings in the canopy allowing for the regeneration of Oregon White Oak, grass and shrubs. To further stimulate the establishment of the White Oak, fire treatments such as underburns would occur to remove competing conifer seedling and saplings.

Existing species composition, which is dominated by Douglas fir , would skew towards a higher percentage of White Oak. Douglas fir would remain the primary conifer species in and around the oak savanna. Follow-up burning at 10 year intervals would be necessary to suppress future conifer encroachment. Without follow-up burning, the surrounding conifers would continue encroaching on the savanna and be back to current levels of canopy cover over the next 20-30 years.

Riparian Thinning

Riparian thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning.

The Riparian Thinning Rx would occur in the riparian area of units: 2, 6, 8, 13, 15, 17, 18, 28, 29, 37, 40, 43, 44, 45, 47, 49, 61, 80, 84, and 88 in alternative B and 2, 6, 8, 13, 15, 17, 18, 28, 29, 37, 40, 43, 44, 45, 47, 49, and 61 in alternative C.

The stands would be thinned to maintain 50% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-24% the SDI^{max}.

Trees removed would primarily be the smaller diameter Douglas fir trees in the stands with the objective to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects.

Riparian thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment of new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 5 to 10 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand.

Group Selection

The objective of group selections is to develop gaps of early seral forest by creating openings with minimal canopy cover. Shade intolerant species that need full sunlight for successful establishment and growth would be able to regenerate in openings created by group selection. Because of the small size of the group selections, there would be an edge affect (shade from residual trees around the edge of the group). Height growth would be higher towards the center of the groups, away from the edge and any leave tree or snags left in the group.

Groups would occur in conjunction with other prescriptions by randomly placing groups based on benefit to wildlife as forage opportunity and other early seral habitat needs for wildlife. Groups would consist of approximate one acre gaps with undulating edges to avoid circles or square edges in the stands. In areas where a pest problem exists, like root disease, the group would be placed on the root rot pocket. A 50' area surrounding root rot pockets would be cleared, resulting in the group select. Openings created by the removal of root rot pockets would not exceed 5 acres in size, and this is expected to be infrequent. Within the groups, all but the four largest green trees per acre are to be removed. Any existing snags and downed trees are to be left on site. Trees adjacent to the group would serve as a seed source, in addition to those left within the groups. Natural regeneration is unpredictable based on timing of cone crops and occupation of the site by competing vegetation. Post harvest treatments to insure reforestation success, may include hand piling and burning and understory burns to remove slash and remove competing vegetation, which could then be followed by tree planting of under represented species to augment natural regeneration. Edge effect and retention of overstory trees could inhibit growth in some seedlings by reducing light and moisture availability.

This prescription would provide for gaps in the stands to increase diversity and forage. Group selects would be randomly placed unless a root rot pocket is identified in which case the root rot pocket would be buffered by 50' and this would become the group select. Group selects would be small holes approximately one acre in size. In the case of a root rot pocket, the group select may be larger than an acre depending on the size of the root rot pocket. All but the largest trees (4 per acre of the largest size class for the pocket) are to be removed. In root rot pocket follow-up planting may occur with species that are non-susceptible to the species of root disease. Large downed wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations. Burning and site preparation for planting would occur if necessary depending on post logging slash load and needed slash components of early seral habitat.

Underburning

Low to moderate intensity underburns would occur in some units following thinning. A effect of the underburn is to reduce competition within the residual stand. In addition, the underburn would affect shade tolerant species more severely than intolerant species, due to shade tolerant species higher susceptibility to fire kill. Greater likelihood of intolerant species naturally regenerating would be a outcome of underburning. Underburning would comply with forest Standard and Guidelines in regards to consumption of fuels and maintaining down-woody material and snags. Spring-like burning conditions would reduce the risk of burning large woody material because of high moisture content. Tolerable loss of residual stand is up to 10% of existing basal area. Any burning is to be in accordance with air quality management district regulations. Underburning would be financed by a combination of appropriated funding and/or collected funds.

Monitoring

First, third and fifth year survival/stocking examinations to monitor seedling survival, natural regeneration, animal damage and need for release or replanting within planted groups would be conducted for harvested stands. A district timber sale review with the District Ranger, IDT Members and Resource Specialists would be conducted within one year of timber sale completion to determine if the prescribed treatments were successfully applied. The effectiveness of the prescribed treatments would be evaluated, providing valuable information for future projects.

Alternatives B and C —Cumulative Effects

Cumulative effects analysis is focused on the USDA Forest Service (FS) land within 20,657 acre McKenzie River / Elk Creek 6th field watershed, which is the Bridge Thin Analysis Area. The analysis area has been molded by past management activities including logging and fire suppression. FS land represents approximately 58% (11,961 acres) of the analysis area with the remainder being private ownership. As displayed in Table 13, in the last 50 years approximately 3,711 FS acres have been managed with regeneration, commercial thinning, or salvage logging and an additional 1,087 acres have been pre-commercially thinned. The 3,711 acres represents 31% of the FS managed land and 18% of the entire watershed. In addition, private land within the project area has had extensive harvest within the past 50 years. There is no reliable source of vegetative age data for private industrial forest lands in the project area, but based on GIS analysis and knowledge of the area, it is estimated that approximately 75%, or 6,400 acres, of the private ownership in the project area is industrial forest land. It is assumed that these lands are being managed on a 40-50 year rotation, so in the past 50 years approximately 6,400 acres of private land in the project area has been harvested. Management of private industrial forest lands is expected to remain consistent for the reasonably foreseeable future.

Timber harvest within older, fire regenerated stands would increase the FS acres of managed stands by 1.58% under Alternative B and 0.32% under Alternative C and the entire watershed by 0.91% and 0.19% respectively. Both action alternatives would include fuels treatments on 1.56% of the FS land 0.90% of the entire watershed.

As stated above, there would be a temporary increase in tree growth in the residual trees within treated units, which would also lead to development of a more diverse understory. The opening of the canopy and holes created in the wildlife thinning units would increase the amount of wildlife forage and early seral forest stands on the landscape in varying amounts. Timber sale activities would reduce the number of natural snags that currently exist within the harvest units, but they would be replaced to some extent by burning induced tree mortality. There are no other foreseeable future projects that would add to the incremental cumulative effects of past timber harvest and the proposed stand treatments.

Soil Productivity and Slope Stability

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Soil Productivity and Slope Stability includes the project activity units in the Bridge Thin Project area.

Affected Environment—Soil Productivity and Slope Stability

Geology

This project area is located within the Lower McKenzie drainage area and lies completely within the Western Cascades physiographic region. More specifically, these deposits are basaltic lava flows, flow breccias and pyroclastic deposits representing both early and later events of the Western Cascade volcanic sequence. Based on field reconnaissance, some small areas of landslide debris area also present as are areas of weathered in-place volcanic rocks. The large majority of this drainage has been reworked by glaciation and surface features are comprised of glacial deposits, such as outwash, ground, end or lateral moraine remnants.

These relatively young rocks and glacial deposits are generally quite stable in this project area. Because of extensive glacial scour, most volcanic rocks are usually not well weathered at this point. Residual soils are often relatively coarse grained, occasionally rocky, and usually contain few clays. Soils developed from glacial deposits, even on the steeper side slopes are usually quite stable. Consequently, because of the gentle side slopes in the valley bottoms, the lack of very fine soil particles in most areas, especially the glacial and outwash soils, and the fact that glacial scour removed deeper pockets of fine-grained soils on much of the steep terrain, most soils are quite stable. These various volcanic land types are generally well drained where permeability is rapid in the surface soil and moderately rapid in the subsoil. On the other hand, the glacial and alluvial soils in the valley bottoms are very well drained, and permeability is rapid to very rapid in both the surface soil and subsurface soil layers. Because of high infiltration rates in the broad valley bottoms, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 30% on the gentler slopes to 40 to 80% on the steeper terrain. Offsite erosion is generally not a concern because of the vegetative ground cover, the high infiltration rates, and the gentle to moderate side slopes for many units.

Areas dominated by rock outcrop, talus or very shallow rocky soils occur in areas of very high relief along steep canyons and mountain landforms. Some of these areas are not suitable for timber production due to difficulties with regeneration. Other areas may be unsuitable because they could become unstable through timber harvest or road construction. However, in this project area, zones of slope instability are relatively uncommon.

For the most part, the soils of the planning area are in good condition. Previous harvest activities did not result in excessive erosion, loss of effective ground cover, or slope instability that could have affected the long-term viability of the soils to support productive healthy forests. However, prior harvest with ground based equipment has resulted in residual soil compaction in many units. The adverse effects and extent of the compaction are within the Willamette National Forest Plan Standards and Guidelines (1990). A more detailed discussion can be found in the Soils Specialist Report in Appendix E.

Environmental Consequences—Soil Productivity and Slope Stability

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

Under this alternative, the soil resource in the near term of a few years would remain relatively unchanged. Stands would continue to develop. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Overstocked stands would rapidly see density increase, growth slow, and mortality rise. Fuel accumulations from blow down, snow down, and bug kill would continue to increase. With bio-turbation and freeze/thaw, compaction would slowly be reduced. Short-term impacts from harvest, such as soil disturbance, dust, and slash accumulation, would not occur. There are no ongoing or reasonably foreseeable projects within the analysis area for soils productivity and slope stability.

Alternatives B and C — Direct and Indirect Effects

A field review of the project area was completed in 2006 and 2007 by a Forest Geologist to verify the present SRI land type boundaries, determine the location of unsuited and unmanageable land types, and to evaluate potential soil impacts from management (see Appendix E).

The activity most likely to result in adverse effects on soil is yarding of timber with ground-based systems. The proposed action, Alternative B, proposed the use of ground-based yarding systems on 770 acres, while Alternative C proposes ground-based yarding on approximately 760 acres. Soil compaction, displacement, and reduced infiltration can occur during timber harvest and road construction activities, which could adversely affect the re-establishment of vegetation. However, best management practices to manage these impacts within acceptable levels have been included in each of these alternatives. In addition, sub-soiling is proposed in ground based units to further reduce compaction levels. Mechanized fuel treatments on many of these acres are also proposed. Past experience with these treatments that typically result in single pass operations that operate on top of slash and on existing skid roads as much as possible is that they do not add substantially to soil impacts. This is supported by a recent study of similar mechanized fuel treatments that involve ground based vehicle mounted mastication equipment. Moghaddas and Stephens (2008). Through the use of suspension and duff retention objectives, short-term impacts of these alternatives would remain within Forest Plan standards and guidelines. Substantial erosion is not likely based on the infiltrative capacity of the coarse textured soils and the implementation of required erosion management BMPs discussed in Chapter 2. Long-term adverse effects from the loss of productivity or instablility would either be within established limits or are not anticipated.

In 2001, McKenzie River District personnel monitored the impacts resulting from the use of ground- based yarding systems in two partial cutting units similar to those proposed in the action alternatives, and on similar landtypes in the Thin Within Timber Sale monitoring, Willamette National Forest (USDA Forest Service, 2001). In both monitoring units, soil impacts were within the acceptable limit of 20% total detrimental condition as required by the Forest Plan. In one of the units, approximately 15% of the area was impacted, and in the other unit, approximately 8 % of the area was impacted. Compaction and displacement on these monitoring units were maintained within acceptable levels by using designated skid trails, placing slash on skid trails to buffer impacts, and operating machines on continuous snow pack. It is reasonable to anticipate similar results for the proposed treatment units in the Bridge Thin Project.

Alternatives B and C — Cumulative Effects

Many of the previously managed stands that were harvested several decades ago were harvested with ground-based systems. Transects through these units indicate that existing compaction from skid roads and landings is approximately 8 to 18%. Bare soil areas no longer exist, although some evidence of disturbance is still evident. The Forest standard for disturbance and compaction is 20% of the unit area, including all roads and landings. Without the implementation of best management practices (BMPs), the potential exists for compaction from this entry to exceed those standards. To minimize the potential for cumulative adverse compaction, all skid road locations would be approved prior to use, and existing skid roads would be utilized as much as possible. After harvest, secondary skid roads would be scarified in order to avoid excessive root pruning. Primary skid roads and landings are proposed for sub-soiling to reduce compaction levels. Based on professional experience, it is estimated that upon completion of activities, compaction would remain at the 15% level or be slightly reduced over the existing levels. These results fall within the range permitted by Willamette National Forest standards and guidelines. There are no reasonably foreseeable future actions that would add additional soil impacts to the cumulative effects of past actions along with this proposed action.

Water Quality/Aquatic Resources (Significant Issue #1)

For each of the analysis items in this section, a discussion of the affected environment precedes the analysis of environmental consequences. The affected environment discussion provides a description of the existing condition, including important physical and biological components of the 6th field watershed in which the project occurs. It also identifies relevant information from applicable watershed analyses that was used to design and assess the project. The environmental consequences discussion describes the effects of the project on the existing condition.

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Water Quality/Aquatic resources includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Stream Shade and Stream Temperature

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest System lands in the 1970s. Much of this activity that occurred prior to implementation of the

Willamette Forest Plan in July 1990, resulted in removal of riparian vegetation that provided shade to streams in the project area. The removal of shade likely resulted in elevated stream temperatures that appear to be represented in current temperature data.

Mill Creek has been identified as having impaired water quality within the Bridge Thin Project area for temperatures in excess of the core cold water habitat standard of 16 degrees C. (Oregon DEQ. 2004/2006. 303(d) List of Impaired Waters).

From June through September of 2005 and 2006, stream temperature data were collected at four locations in the project area to support project analysis. The core cold water habitat temperature criteria of 16 degrees C. would apply to all of these streams.

A summary of this data is provided below in Table 14 along with data from Walker Creek, which is an unmanaged wilderness stream of similar size and basin characteristics to Mill Creek.

Table 14. Average Stream Temperatures.

Stream Name	Average 7-day average of Maximum Temp. ° Celsius 2005 Data	Average 7-day average of Maximum Temp. ° Celsius 2006 Data	Range of Values	Average Value	Change from Control
Cone Creek (Control)	16.6° C	18.1° C	1.5° C	17.4° C	NA
Un-named Class 3 Tributary	17.4° C	18.6° C	1.2° C	18.0° C	0.6° C
Walker Creek (Control)	14.5° C	NA	NA	14.5° C	NA
Mill Creek at Forest Boundary	14.2° C	15.8° C	1.6° C	15.0° C	0.5° C
Mill Creek at Hwy 126	20.0° C	21.2° C	1.2° C	20.6° C	NA

The existing conditions for stream temperatures in the Bridge Thin project area appear to be slightly elevated above control conditions as a result of timber harvest. Both Upper Mill Creek and the un-named McKenzie tributary that flows northward to the river are approximately 0.5 degrees C warmer than geologically and hydrologically similar control streams that have been predominantly un-impacted by land management activities. This is not a definitive difference based on only a few years of data, but the safe approach is to assume that the difference is attributable to past harvest that has reduced shade in these drainages.

Lower Mill Creek is dramatically warmer (approximately 5.5 degrees C) than the site on Upper Mill Creek. This is most likely due to a combination of agricultural, residential, and recreational impacts on private lands on the floor of the McKenzie valley, in combination with influent stream conditions as Mill Creek loses water to deep, porous glacial terrace deposits on the valley bottom.

The range of maximum temperatures from one water year to the next did not substantially differ, nor did the annual timing of the maximum temperature, which occurred between July 20 and August 10 in all instances. This suggests that management has impacted only the increased value for maximum temperature and has not affected inter-annual variability or annual timing of peak temperatures.

Environmental Consequences—Stream Shade and Stream Temperature

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

Activities that affect stream-shading vegetation would not occur, and direct, indirect, or cumulative effects of this alternative on stream temperature are not anticipated. Water temperatures in streams in the project area would continue to recover toward more natural levels, as riparian vegetation that was disturbed or removed by management activities prior to implementation of the LRMP re-grows and re-establishes streamside shade.

Alternatives B and C — Direct, Indirect, and Cumulative Effects

For all action alternatives, treatments within riparian areas have been designed to fully comply with "Northwest Forest Plan Temperature TMDL Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI Bureau of Land Management. 2005). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, 2002). The Implementation Strategy provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Trees within the stands proposed for treatment are 80 - 150 feet tall currently, and slopes typically fall within a 10% to 70% range. All fish bearing and perennial streams (Class 1 -3) are provided with a minimum of 60- feet of primary shade buffer to retain effective shade for stands of this height and these slopes. Intermittent (Class 4) streams are dry during the portion of the year that elevated temperatures are a problem. However, bank stability trees and 30 foot no harvest buffers would be retained for other resource objectives, and would provide substantial shade regardless. For all classes of stream, at least 50% crown closure would be retained within the entire remainder of the riparian reserve, including that portion which may provide secondary shading benefits.

Based on implementation of the design criteria outlined in the preceding discussion and field observations during project reconnaissance, no measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area, as a result of these alternatives.

Consequently, as in the No Action Alternative, water temperatures in Mill Creek and other streams in the project area would continue to recover toward more natural levels, as riparian vegetation re-grows and re-establishes streamside shade. Incremental increases or decreases in the rate of recovery as a result of implementation of this alternative are not anticipated.

Alternatives B and C—Conclusions

Based on the previous discussion and field observations, no measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area as a result of any of these alternatives. The magnitude of cumulative increases resulting from past management activities were disclosed in the earlier Affected Environment discussion and there are no reasonably foreseeable actions that would not comply with TMDL requirements for the McKenzie Basin.

Affected Environment—Stream Flows/Disturbance History

Traditionally, projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage or ARP. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed, and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average 8" dbh and crown closures exceed 70%. The transient snow zone is generally considered to include those areas of the forest between the elevations of 1,500 and 4,000 feet respectively. The analysis is based on data extracted from the Forest's VEGIS database, which includes information about all past harvest activities in the sub-watershed. Currently, ARP levels in the McKenzie River/Elk Creek Sub-watershed stand at 88.31%, which is well above the Forest Plan Midpoint of 80%.

Since we had no reliably consistent source of vegetative age data for private industrial forest lands, we developed an average vegetative stand age for these lands that would remain steady over time. Treating these lands as zero percent recovered, or 100 percent recovered, was not intuitive. We assumed that these lands were managed over an average rotation length of 45 years, and that harvest occurred at a steady rate over the life of the rotation. This yielded an average stand age of 23 years over time, which equates to an ARP value of 88%. We also estimated the percent of these lands that were occupied by roads, based on some photo analysis. As a result, we assumed that 6% of these lands would be 0% recovered. We subtracted the 6% attributed to roads from the 88% ARP value and arrived at an adjusted ARP value of 82% that we could apply to these lands.

Environmental Consequences—Streams Flow/Disturbance History

Alternative A (No Action)—Direct and Indirect Effects

Alternative A, No Action, would result in no changes to existing peak flows, having no direct, indirect, or cumulative effects on streams flow in the project area.

Alternatives B and C—Direct and Indirect Effects

Table 15 below summarizes levels of recovery immediately after implementation of the project for each of the alternatives. The incremental change associated with each alternative is determined by comparing these values with current condition values above in Table 14.

Table 15. Recovery Levels Immediately after Project Implementation (2010).

Sub-watershed	Alternative A (No Action)	Alternative B	Alternative C	Midpoint ARP
McKenzie River/Elk Creek	88.31%	88.26%	88.26%	80%

Examination of this information indicates that ARP levels are maintained well above recommended values by all alternatives in the affected sub-watershed, even immediately after implementation when the potential for impacts to vegetative recovery would be greatest. Therefore, no altered peak stream flow regimes are anticipated from implementation of the proposed actions.

Alternatives B and C—Cumulative Effects

As previously discussed, Aggregate Recovery Percentage (ARP) provides an analysis of the cumulative impacts of past management activities, and actions included in the alternatives for this project. There are no reasonably foreseeable future actions on Forest Service or private lands within the project area that would result in effects that differ from those already disclosed for each of the alternatives.

Affected Environment—Sedimentation and Roads

The geologic terrain and soils of the Bridge Thin Project area are not inherently prone to extensive erosion unless disturbed as discussed in the Soils Specialist Report in Appendix E. However, beginning in the 1940s road construction and timber harvest began in the project area, peaking on National Forest system lands in the 1970s and continuing at somewhat higher levels on private lands within the sub-watershed. As discussed in the Soils Report, past timber harvest methods were employed on National Forest system lands that managed for minimal soil disturbance, but did result in compaction levels varying from 8% to 18% of those acres that were harvested with ground based logging systems. Road construction on the gentler portions of the project area on broad terraces adjacent to the McKenzie resulted in displacement, but little off site transport of sediment to streams, except at crossings.

Roads on the deeply dissected slopes above the riverine terraces, especially those roads constructed during the earlier part of the time period, employed construction methods such as cut and fill that resulted in relatively unstable facilities. These roads continued to produce sediment during storm events as unstable portions of road fills failed and resulted in debris torrents. Since implementation of the Forest Plan in 1990, road maintenance activities have worked to eliminate many of these unstable fill situations. Many were repaired to the higher standards after their initial failure. Even so, roads continue to be the largest source of human-caused sedimentation in the project area, especially at stream crossings where road sediment can enter streams and undersized culverts can fail during flood events. Based on observations of existing road conditions during field reconnaissance for the project, sediment outputs from roads were estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The current sediment yield from roads is estimated at 247 cubic yards per year for the project area.

The McKenzie River Sub-Basin, including the Bridge Thin Project Area, provides municipal water to the City of Eugene by way of the Eugene Water and Electric Board’s intake at Hayden Bridge, approximately 50 miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Bridge Thin Project that could adversely affect municipal water quality.

As was discussed in the Soils discussion and further detailed in the Soils Specialist Report in Appendix E, project area soils are predominantly coarse textured and are characterized by a relative lack of clay mineral components. These soil characteristics result in minimal impacts to turbidity, even when sediment is being moved. This was observed first hand by reconnaissance during a storm event in October 2007. In addition, broad, porous, riverine terraces adjacent to the McKenzie create shallow stream gradients and conditions where streams lose water to the soil. These terraces range from a quarter mile to more than a mile wide in places, creating ideal conditions for streams to lose water and velocity and a resultant reduction in sediment carrying capacity. This landform is so effective in controlling runoff that only the largest streams are able to pass through the terraces as perennial streams. Observation of one large un-named tributary that suffered a failed road crossing after the 1996 flood showed an eroded gully below a catastrophic road failure that completely attenuated on the terrace and failed to deliver material to the McKenzie River.

Environmental Consequences—Sedimentation and Roads

Alternative A (No Action)—Direct and Indirect Effects

Alternative A, No Action, continues the current management situation regarding roads maintenance in the project area. This alternative would not change the potential for sediment delivery to streams from roads in the project area.

Alternatives B and C—Direct and Indirect Effects

The area of analysis for the direct, indirect, and cumulative effects of riparian habitat enhancement is the McKenzie River/Elk Creek 6th Field Sub-watershed. Road reconstruction work associated with the Bridge Thin Project includes replacement of a number of culverts that are currently in poor repair or inadequately sized to pass "Q100 flows", or a flood that has a 1% probability of occurring in any given year. Replacement will require in-stream work in these streams. Work will be done during non-flow periods for intermittent streams, and engineering practices such as sediment barriers and flow bypass will minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 1.0 cubic feet per second when work occurs, based on personal observation during project reconnaissance. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 2.0 cubic yards per installation based on professional experience. The culverts currently represent an elevated risk of fill failure because the culverts to be replaced are in poor condition or are undersized for Q100 flows. Discussion with engineering personnel indicated that the average fill volume is 250 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culvert fails. Table 16 provides a summary of these replacements and the potential amount of fill material that would have a reduced risk of entering streams, as well as estimates of the amount of sediment produced from the culvert replacements. The maximum estimate of sediment yields from the culvert replacements would be 58 cubic yards for Alternative B and 62 cubic yards for Alternative C. In comparison, the approximate cubic yards of fill stabilized for Alternatives B and C are 7,250 and 8,000.

Table 16. Culvert Replacements in Perennial and Intermittent Streams by Alternative.

	Stream Type	Number of Culverts Replaced	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
Alternative A (No Action)	Intermittent	0	0	0
	Perennial	0	0	0
	Total	**0**	**0**	**0**
Alternative B	Intermittent	20	5,000	10 - 40
	Perennial	9	2,250	4.5 - 18
	Total	**29**	**7,250**	**14.5 - 58**
Alternative C	Intermittent	20	5,000	10 - 40
	Perennial	12	3000	6 - 24
	Total	**31**	**8,000**	**15.5 - 62**

In addition, the perennial culvert replacement that is included in Alternatives B and C only would occur where Mill Creek crosses Road 2633-720. This crossing would be designed to meet 100 year flows, which would also permit restoration of fish and amphibian species to and from stream habitat above and below the crossing.

All temporary roads that would be used in the action alternatives are situated on stable terrain, and all are situated where the potential for extension of drainage networks is negligible. These conditions make run-off and transport of sediment from disturbed soils unlikely, and consequently minimal amounts of sediment are expected to reach stream channels as a result of this activity.

All action alternatives would implement the road management activities listed in the description of each action alternative, as detailed in Chapter 2. The following table provides additional information about road maintenance:

Table 17. Road Maintenance Summary.

	Alternative A	Alternative B	Alternative C
Miles	0	34.3	33.7
New/Replacement Relief Culverts	0	42	45

As a minimum, these activities would include maintenance of proper drainage through maintaining existing structures, installing water bars, or restoring natural drainage features. Also included would be the installation of new-ditch relief culverts and replacement of existing ditch-relief culverts that are currently in poor condition. These actions would reduce the likelihood of sediment leaving the road with runoff by reducing the average distance between drainage structures and consequently, the amount of water that each structure needs to handle. Less water translates to less sediment-carrying capacity

Alternatives B and C—Cumulative Effects

As was disclosed in the discussion of the affected environment, an analysis of estimated sediment outputs from roads in the project area was completed using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The same analysis was conducted for the project area road system for each of the alternatives, incorporating all project related road maintenance, reconstruction, and temporary construction activities, as well as product haul. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. The results are summarized in the following table.

Table 18. Estimates of Sediment Production Rates.

	Alternative A (No Action)	Alternative B	Alternative C
Road Sediment Yield During Implementation (CuYd/Yr)	247	272	271
Road Sediment Yield after Implementation (CuYd/Yr)	247	230	227

Rates of road related sediment yield remain constant under the Alternative A (No Action), reflecting no specific changes in ongoing road treatments or conditions. For each of the action alternatives, annual sediment yield increases during the life of the project as a result of project activities. This represents an incremental increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. However, each of the action alternatives also show a net incremental decrease in annual sediment yield after completion of the project. This reflects the lasting results of improvements made to the existing road system as part of the project, and represents an incremental reduction in the cumulative amount of road generated sediment.

Affected Environment—Riparian Habitat Improvement

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest system lands in the 1970s. Much of this activity that occurred prior to implementation of the Willamette Forest Plan in 1990 resulted in removal of riparian vegetation that provided large wood and shade to streams in the project area. The effects of these actions on stream shade and stream temperatures were included in analysis discussion. From these discussions, it is clear that the removal of wood resulted in reduced availability of large wood for in-stream and riparian habitat. The purpose of this analysis is to disclose some the effects of this project as well as other recent projects which begin to address the need to restore the large wood component to riparian stands.

Primary streams within the McKenzie River/Elk Creek 6th Field watershed include Elk Creek/Cone Creek, and Mill Creek and the main stem McKenzie River. Other streams located outside the 6th field watershed in the immediate vicinity and tributary to the McKenzie River include Quartz Creek, Blue River, South Fork McKenzie River, and Horse Creek.

The watershed is located in the Western Cascades region, and marks the lower extent of Pleistocene glaciation in the McKenzie River sub-basin. The planning sub-watershed is characterized by glacial terraces that are porous (composed of coarse glacial deposits) that infrequently allow channels draining side slopes north and south of the river to make surface water connection to the McKenzie River. Landslides, torrent events and mass wasting, while completely natural and essential to aquatic habitat health over a large scale and long term developmental scale, are often intercepted by the glacial terraces. The broad glacial terraces, ranging in width from 1,000 feet to one mile, are low gradient barriers between the McKenzie River and steep slopes above. The effect to aquatic habitat quality is to intercept the products of disturbance; debris and sediment. The exceptions on the north side of McKenzie River are two small tributaries, Elk/Cone Creek and Mill Creek, and on the south side, two unnamed tributaries. The named tributaries function as typical Western Cascade tributaries that historically delivered debris and sediment to the McKenzie River. Elk Creek continues to function much as it has historically, with a bridge crossing at Hwy 126 allowing most disturbance products to reach the McKenzie River. Mill Creek is more prone to have its transport products filtered (woody debris transported by the channel) by the culvert at Hwy 126 crossing.

Elk Creek is largely unmanaged and possesses a low road density. Elk Creek channel conditions reflect a low level of management, with good habitat quality and in-stream wood density. Mill Creek and unnamed tributaries to the north and south of the McKenzie River reflect recent timber management and high road density in their aquatic habitat condition. Low in-stream wood volumes, altered sediment storage capacity and aquatic habitat quality are less able to provide for the life history requirements of native aquatic organisms.

Environmental Consequences—Riparian Habitat Improvement

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Implementing Alternative A, No Action, would have no effect on riparian habitat. An increased risk of loss of riparian stands to catastrophic fire, carried more efficiently through un-thinned riparian stands, exists. Densely stocked riparian stands suffering mortality from fire disturbance would contribute pulses of wood to adjacent stream channels, with short-term loss of stream shading in fire affected stands. The scale of fire disturbance would not be expected to exceed the historic fire disturbance on this landscape, when considered in combination with expected fire suppression.

Alternatives B and C—Direct and Indirect Effects

Area of riparian reserves thinned (Alt. B= 145 acres; Alt.C =137 acres) within stands and receiving fuel thinning treatments (142 acres for both action alternatives) are similar. Table 19 summarizes the percentage of riparian reserves affected by fuels treatments or harvest.

Table 19. Percent Riparian Acres Prescribed for Riparian Thinning and Fire Treatment (Within the McKenzie River/Elk Creek 6th Field sub-watershed)

Activity	Alternative A (No Action)	Alternative B	Alternative C
Based on Percentage of Riparian on Federally Managed Lands within the Project Area			
Riparian Thinning	0%	12.6%	11.3%
Prescribed Fire	0%	10.0%	10.0%
Based on Percentage of Riparian within the Project Area (including Private Lands)			
Riparian Thinning	0%	4.7%	4.2%
Prescribed Fire	0%	3.7%	3.7%

One of the expected results of thinning in riparian reserves is that stand structure, especially the development of larger diameter trees, can accelerate forests toward late-successional conditions. Partial cutting can also accelerate development of large diameter trees that would eventually fall and provide large wood structure in streams and adjacent riparian areas. Maintaining the existing hardwood component also adds to structural diversity and complexity.

Introduction of low severity fire into riparian reserves is also anticipated to increase the plant species and stand structural diversity. At low burn severities, large wood would not be removed from the reserves. In addition, with local differences in soil moisture and relative humidity, the pattern of burning in the riparian reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing under story vegetation including conifers would be retained. In lightly burned areas, under story conifers would experience some mortality, but fire “endurer” species such as willow and other hardwood shrubs would re-sprout and in some instances be stimulated into increased growth in response to the disturbance. The net result would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than non-thinned plantations. Riparian reserve effects discussion, summarized here, is further described in the Fisheries Biological Assessment and the Aquatic Conservation Strategy Consistency (Appendices A and B).

Alternatives B and C —Cumulative Effects

At the 6th field watershed scale, riparian areas on non-federal forest land (as regulated by riparian protections provided by Oregon Forest Practices) are expected to contribute a steady, low level of recruitment potential compared to historic contribution. Recruitment potential provided by river and stream adjacent rural residential property is expected to continue on a rate of decline.

The quantity of significant-sized large woody material (those 24 inches in diameter or greater) available on federally managed land to project area channels is expected to increase through time, in part accelerated through riparian reserve treatments proposed in the Bridge Thin project. Deficits of in-stream wood identified during surveys of channels in the project are expected to begin gaining in density and volume. Combined with riparian reserve protections provided by the Forest Plan, and thinning treatments proposed with action alternatives, the composition of thinned riparian reserves is expected to look less uniform and contribute a higher quality habitat element (compared to deficits in larger tree diameters found in-stream and within riparian reserve stands currently in the sub-watershed). Bridge Thin project riparian reserve thinning proposal would maintain existing hardwood elements within the reserve and maintain hardwood stand diversity and complexity.

A short-term reduction in current stem number available to channels adjacent to thinned federal reserves would occur with action alternatives. Riparian stand thinning within 60 feet of perennial channels (consisting of skyline corridors) is low in magnitude, and is expected to maintain aquatic habitat quality. The removal of thinned trees capable of contributing immediately to in-stream habitat (and influenced by action alternatives) are generally located between 60 and 100 feet distant from the channel, consisting of the upper half to upper third of tree, composed of small diameter of minor longevity and sediment storage value to current habitat. A similar rate of recruitment from among stands 0-60 feet from perennial channels is expected (compared to Alternative A), where no thinning occurs with action alternatives.

Affected Environment—Aquatic Resources

The following description of aquatic resources describes fish species considered Management Indicator Species (those native and anadromous fishes described below) in the Willamette Forest Plan. The scale of analysis of effects on aquatic resources describes the McKenzie River/Elk Creek 6th Field sub-watershed, evaluated at this scale due to the project footprint and potential effects of project activity downstream.

Management Indicator Species

Fish historically present in the project area include mountain whitefish (*Prosopium wouldiamsoni*). Mountain whitefish are currently common in main stem McKenzie River, although fragmentation of habitat at Cougar and Blue River flood control dams, likely limits the extent of habitat meeting their life history needs. This river dwelling fish historically had access to higher quality habitat in the project area (meeting migration, reproductive, rearing and foraging needs) and were expectedly more numerous.

Native rainbow trout (*Oncorhynchus mykiss*), with similar distribution to whitefish, are river dwelling in the main stem McKenzie River and larger tributaries. The robustness of McKenzie River rainbow trout populations following completion of Cougar and Blue River dams is believed diminished. The combination of habitat condition and ODFW stocking of non-native fall spawning rainbow and introduced summer steelhead, is believed to suppress native rainbow trout abundance in the project area through fragmentation of habitat, habitat degradation, and competition with non-native species.

Native cutthroat trout (*Oncorhynchus clarki clarki*), are the most widely distributed fish in the landform, ranging from headwater streams (Class II perennial and intermittent fish-bearing streams in the project area provide habitat for cutthroat trout) to the main stem McKenzie River. Some cutthroat trout are found in Class II intermittent channels that drain project valley walls, but flow subsurface through valley bottom glacial deposits, effectively isolating these small populations from larger channels. Surface flow connectivity of these small channels to main McKenzie River occurs only during high flow/flood events. Previous timber management in riparian areas has affected aquatic habitat quality in cutthroat tributaries by altering the quantity, size and supply of in-stream woody material.

Use of tributaries by Western brook lamprey (*Lampetra richardsoni*) is documented in low gradient, fine-grained sediment channels and backwater areas. Stream classifications of Class II (fish-bearing) channels identify habitat currently utilized by Western brook lamprey. The extent of brook lamprey distribution compared to historic distribution is believed reduced in the project area, through loss of floodplain connectivity and modification of wetlands with rural development. Brook lamprey use of habitat is as juvenile (ammoceoete) rearing and adult reproduction. Ammoceotes are filter feeders, eating microscopic plant and animal matter (diatoms, algae and detritus) as they develop, buried in sediments. Adults do not feed during their short life of several months.

Listed Species Distribution and Habitat Requirements

Native spring Chinook salmon (*Oncorhynchus tshawytscha*) migration, reproduction and rearing occur in the project area in the main stem McKenzie River and overlaps current and historic bull trout distribution in the project area. Populations of listed species present and access to habitat in main stem McKenzie River and South Fork McKenzie River have been fragmented with construction of flood control and hydroelectric projects. The distribution and access to habitat of spring Chinook salmon and bull trout in the McKenzie basin has changed with construction of dams by Army Corps of Engineers, and Trail Bridge Dam (1963) by Eugene Water & Electric Board. Chinook access to 18 miles of historic habitat in the South Fork McKenzie River is interrupted by Cougar Dam, and about 4 miles of historic habitat above Trail Bridge Dam. A run size of 5,360 spring chinook is estimated to have used the South Fork McKenzie River based on redd numbers in 1956. A run size of about 200 spring Chinook is estimated to have used the McKenzie and Smith Rivers above current Trail Bridge

Dam. In an effort to restore marine-derived nutrients provided by spring Chinook and a source of bull trout prey supplied by naturally produced Chinook juveniles, ODFW places spring Chinook adults above Cougar and Trail Bridge Dam by trap and haul. Chinook salmon access to habitat below dams remains unobstructed (a fish ladder provides passage over Leaburg Dam at McKenzie river-mile 39). Current distribution of spring Chinook spawning production above Leaburg Dam is estimated at *30% in the mainstem McKenzie between the Leaburg Dam and the South Fork McKenzie confluence* (this area includes the project area reach); 10% spawning in the South Fork McKenzie below Cougar Dam; and 60% in the mainstem McKenzie above the South Fork McKenzie confluence. Current returns of Chinook adults above Leaburg Dam range from 1,110 (1997) to 9,913 (2003).

The vicinity of the project area and McKenzie River downstream of the project area is utilized by spring Chinook as spawning habitat, juvenile rearing habitat, and as a migration route to spawning habitat by adults and emerging fry from incubation areas. Low gradient reaches of the McKenzie River in the project area are used as spawning habitat by spring Chinook salmon. Spawning in these reaches occurs in September and October, with fry emergence about 3 months later. Fry emergence in the main stem McKenzie River is followed by migration of most fry to Columbia River estuaries, then the Pacific Ocean, with a portion of the emerging fry residing in low velocity, off-channel and tributary habitat of the McKenzie River for their first year of life. Habitat requirements of spawning adults are cold, clean water and channel substrates low in fine sediments. River and stream channels with a variety of flow velocities provided by riffles and pool tail-outs (adult spawning habitat), deep pools (adult holding habitat), off-channel areas and tributaries (juvenile rearing habitat), in-stream wood as a source of cover (for adults and juveniles) and pool scour. These habitats provide optimal conditions for spring Chinook salmon. Water temperatures necessary for optimal salmon spawning range from 5.6 – 12.8 degrees Celsius; egg incubation 4.5 - 12.8 degrees; juvenile rearing from 10.0 - 15.6 degrees.

The McKenzie River sub-basin provides habitat for the largest remaining portion of wild spring Chinook in the Willamette Basin. High water quality in the form of cold water temperature and good habitat quality remaining in the upper sub-basin provides the largest remaining core area for spring Chinook salmon reproduction and rearing in the basin. The project area portion of the sub-basin historically provided greater quantity and quality habitat with a greater level of channel complexity and off-channel area. River adjacent development (rural residential development and bank hardening), reduced large wood recruitment potential, and modified flow, sediment and wood routing regimes (as modified by dams and roads), have diminished salmon production in the project area. Mitigation of salmon production lost to flood control dams is supplemented by use of hatchery production. Hatchery production is believed to have altered wild spring Chinook persistence and genetic integrity in the sub-basin. Loss of local adaptation has likely occurred as a result of significant levels of straying and use of hatchery-origin spring Chinook. Changing emphasis in Oregon to native fish production (transport and passage of salmon into historic habitat, and lowered dependence on hatchery production) is expected to provide for improved wild salmon production, and recovery of locally adapted stocks. Completion of the Cougar Temperature Control Project in 2005 by ACOE has restored historic temperature regimes in this portion of the sub-basin and is expected to improve incubation survival and migration timing in the project reach of the McKenzie River. Spring Chinook salmon are listed as Threatened and protected under the Endangered Species Act. Spring Chinook recovery efforts include a proposed Trap-and-Haul facility at the base of Cougar Dam, which is expected to improve migratory connectivity between main stem McKenzie River and the South Fork McKenzie River above the dam. The project is planned by ACOE to be implemented beginning in 2008.

Bull trout (*Salvelinus confluentus*) use of the McKenzie River in the project area is as a migratory corridor, and sub-adult and adult foraging habitat. River temperatures are naturally too warm in this portion of the McKenzie sub-basin to provide bull trout spawning and early rearing habitat (bull trout spawning/early rearing areas are located in spring-fed tributaries about 16 miles upstream of the project area).

Sixteen miles upstream of the project area, Anderson Creek, Olallie Creek and a small portion of McKenzie River channel immediately downstream of Trail Bridge Dam provide the only known bull trout spawning and rearing habitat for the main stem McKenzie bull trout population. In all known spawning tributaries, exceptional habitat and water quality conditions provide for the reproductive needs of bull trout within a narrow temperature range. Bull trout spawning occurs between 4-10^{o}C, embryo incubation between 1-6^{o}C, and juvenile rearing between 4-10^{o}C (Spence et.al 1996). The spring-fed Anderson and Olallie Creek provide optimal bull trout spawning temperatures of 4-7^{o}C, with lower temperatures available during the fall and winter incubation period. Once bull trout fry have emerged from gravels of these streams, optimal rearing temperatures are available at 4-7^{o}C.

The project area reaches of the McKenzie River and portions of the McKenzie River downstream of the project area are utilized by bull trout as sub-adult (approximately 3-5 year old bull trout) and adult (6-10 year old bull trout) foraging habitat, and as a migration route to and from spawning habitat. Bull trout migration through the project area, en route to spawning habitat, occurs upstream beginning in late spring and downstream following completion of spawning in fall. Historic channel complexity is expected to have provided greater quantity and quality for prey species, particularly spring Chinook salmon, and for greater numbers of foraging bull trout. Bull trout are currently listed as Threatened and protected under the Endangered Species Act.

Bull trout populations in the McKenzie River and South Fork McKenzie River have been isolated by the Cougar and Trail Bridge Dams. Three separate populations of bull trout currently exist in the McKenzie sub-basin. Above Trail Bridge Dam in the main stem McKenzie, an isolated Trail Bridge bull trout population consists of about 50-75 adults. Above Cougar Dam, an isolated South Fork McKenzie bull trout population consists of about 75 adults. Below the dams, the main stem McKenzie River bull trout population consists of about 150-200 adults. The distribution of listed species and habitat utilized by spring Chinook salmon and bull trout in the vicinity of the project area is illustrated in the Biological Assessment appendix. Bull trout recovery plans include a proposed Trap-and-Haul facility at the base of Cougar Dam, which is expected to improve migratory connectivity between main stem McKenzie River to the South Fork McKenzie River above the dam (and access for migrants to spring-fed spawning habitat in Roaring River). The project is planned by Army Corps of Engineers (ACOE) to be implemented beginning in 2008. Additional description of Endangered Species Act listed aquatic species is found in the EA appendix (Biological Assessment for Spring Chinook Salmon and Bull Trout).

Aquatic Habitat Quality

A major influence on the mainstem McKenzie River channel condition in the vicinity of the project is the presence of flood control dams upstream. Cougar (completed in 1963) and Blue River (completed in 1968) dams have altered the flow regime and sediment supply to the mainstem McKenzie and cut off sediment supply from over half of the drainage area (Minear 1994). Minear also noted a reduction of large woody debris in the 1986 channel as compared to historic aerial photos from 1949, indicating a reduction in pool-forming agents and channel roughness elements. Increases in development along the McKenzie River, including timber harvest and roads, have resulted in a 44% reduction in riparian area mature conifers and 45% increase in hardwoods from levels in the 1940's.

Completion of Cougar and Blue River flood control dams during the 1960's have had significant effects on aquatic habitat quantity and quality within and near the project area. Accessible habitat for migratory and river dwelling native fish was fragmented and reduced with completion of the dams. Interception of substrate supply to the main stem McKenzie by dams has resulted in channel down cutting, substrate coarsening and abandonment of off-channel habitat (Minear 1994). The flood control dams and road system have diminished aquatic habitat quality through interception of woody material as it migrates toward larger channels. Maintenance of river navigability and river adjacent development has also reduced in-stream wood volume and supply. As a result, McKenzie River channel complexity has changed toward a simplified, single channel, where it had historically provided complex off-channel habitat more suited to a variety of life history stages of native fish.

Environmental Consequences—Aquatic Resources

Additional discussion of effects of proposed actions to aquatic resources is described in the Fisheries Biological Assessment (Appendix B).

Alternative A (No Action)—Direct, Indirect Effects

The no action alternative would leave roads untreated, yielding sediment similar to current levels. Project recommendations described would not be implemented. Ground disturbing activities associated with thinning operations, temporary road construction, pit development and fuels treatment would not occur. Landscape delivery of fine sediment, as modified by the road and stream crossing network, would remain largely as it is and subject only to scheduled maintenance (periodic road grading, ditch cleaning and culvert maintenance). The current fine sediment delivery rate as modified by the road network, would remain within the range of conditions necessary to sustain native aquatic biota, but not optimally so. Periodic stream crossing failures may occur at undersized and outdated (especially log) culverts. Culvert failures may induce stresses on resident fish populations, but not at magnitudes that would be expected to extirpate local populations such as cutthroat trout. The effect of no action upon listed species habitat use and distribution in the McKenzie River would yield fine sediments similar to current levels, with potential to produce sediment pulses associated with crossing failures. Those risks are evident at stream crossings of the 2633 system roads, with direct connection to the McKenzie River. Risks at the stream crossings of the 1900 system roads are negligible due to the lack of surface connection with the McKenzie River.

Alternative A (No Action)—Cumulative Effects

The current road density in federally managed portions of the sub-watershed would remain near 4 miles per square mile. Continuing rural residential development in the sub-watershed (approximately 40% privately owned) may be expected to increase, based on recent trends of private development. Greater development in non-federal portions of the sub-watershed may be expected to increase the concentration of surface water on impermeable surfaces and increase fine sediment yield. Industrial timberland harvest rates are expected to continue at about a 40 to 50 year rotation and yield fine sediments at a relatively constant rate, supplied by private road networks and ground disturbance associated with timber management. Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by Management Indicator Species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through population(s) access to historic refuge areas. The No Action Alternative would maintain habitat conditions currently available to aquatic MIS fish and ESA listed aquatic species.

Alternatives B and C—Direct and Indirect Effects

Potential downstream effects of timber harvest and fire treatments to habitat important to Management Indicator Species, including spring Chinook and bull trout is expected to be negligible due to treatment scale, low severity, distance of activity from stream channels/Listed Species Habitat, and the low density of tributary channels in the project area. Few project area tributaries possess surface water connection to the McKenzie River, minimizing potential to affect Listed Species Habitat. Short-term increases in sources of sedimentation from ground disturbing activity (primarily through road reconstruction, culvert replacement, temporary road construction and timber haul) are expected to occur at the site-specific level.

Habitat of importance to listed species could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity or during wet periods. However, distance of culvert replacements (no closer than 1 mile to listed species habitat) and seasonal restrictions would maintain habitat conditions for at-risk species (mitigation measures table). The net effect of resurfacing activity is to simultaneously reduce road origin fine sediment while replacing undersized and aged culverts. The use of best management practices and mitigation measures to trap fine sediments during culvert replacement is expected to minimize impacts to aquatic habitat and resources, with a negligible increase in sources of suspended sediment. Localized increases in turbidity during and following the season of culvert replacement, is believed to remain within the habitat needs of all aquatic MIS species. Decommissioning of road surfaces and culvert removal would similarly be required to meet seasonal restrictions, limiting the transmission of fine sediment.

Rock Quarry development would take place in the existing Mill Creek Rock Quarry located on FS Road 2633-720. The pit is currently 4 acres and there would be 0.5 acres of new development. Approximately 15,000 cubic yards of material is planned for extraction to use for road reconstruction and maintenance activities. No timber would be removed for new development. The nearest perennial streams are over 1,000 feet away. Mill Creek Rock Quarry is located 1.6 miles from LFH. Therefore, the potential to transmit fine sediment is minimal.

Road maintenance activities would occur during dry season and would be required to be maintained in stable condition during hauling (aquatic mitigations 3 and 4). Combined with improved and new ditch relief placements (42), the improved transportation system is expected to have negligible effect on aquatic habitat in the immediate vicinity of roads (from reconstruction and haul) and minimal effect on listed species habitat, most of which is 0.5 mile or greater from road locations (short-term, localized increases in sources of fine sediment over background levels).

Haul route proximity to aquatic habitat is favorable in terms of mitigating effect on potentially mobilized sediments from the road system south of the McKenzie River (1900 system roads). Haul routes on the north side of the river, in close proximity to the McKenzie River are largely paved (Hwy 126) or are aggregate roads that would be reconstructed to accommodate haul. Maintenance activities, seasonal hauling restrictions and surface water disconnect between the haul routes and McKenzie River would ensure that fine sediments are negligibly transmitted to the river. Aggregate and native surface portions of the haul route on the north side of the river (Rd 2633, 1500 and 1501 system roads), where tributaries connect directly to the McKenzie River, would be improved through reconstruction to accommodate haul and minimize mobilization of fine sediments. The lower-most crossing of the haul route within Mill Creek drainage is 1.5 miles from listed species habitat, and poses little potential to transmit fine sediment sufficient to measure in the McKenzie River. An unnamed tributary to the east of Mill Creek flows through a series of golf course ponds before reaching the McKenzie River, providing the opportunity to store mobilized sediments. Turbidity transmitted from upstream has no opportunity to transport through this low gradient portion of glacial terrace and reach the McKenzie River. The haul route in closest proximity to McKenzie River is Hwy 126, paved for its length through the project area.

Wet season haul would be allowed only on maintained aggregate or paved roads (aquatic mitigation measure 2 and 4) to protect water quality and fish habitat. When roads become excessively dusty, watering of roads is required. The net effect of these measures has been found effective at minimizing sediment mobilization and maintaining aquatic habitat quality.

Construction of 3.1 miles of temporary road would occur only on stable landforms. Where stream crossings are necessary, clean stable fill material would be used. Seasons of temporary road construction are limited to dry season only, to limit potential to transmit fine sediment.

Logging and yarding systems are subject to a variety of restrictions. Aquatic mitigation measures 5–17 are designed specifically to maintain water and habitat quality. The effect of minimizing skyline corridors and requiring riparian corridor trees be left on site, is to ensure ground disturbance remains insignificant and stream bank stability is maintained. Action alternatives would utilize 57 skyline corridors over perennial channels, and 38 corridors over intermittent channels. Removal of stream adjacent trees includes an increased risk of transporting fine sediments in channels immediate to the corridors. Short-term and local increase in turbidity is expected during the season of yarding. The magnitude of effect is expected to remain within the range of life history needs of resident fish (Unit 40 with 10 skyline corridors over a fish-bearing channel). The ability of channels to transport fine sediment to listed fish habitat is limited by distance removed (ranging from 0.3 mile to 2.7 mile) and mitigations requiring full suspension and retention of corridor trees. In Class 4 channels, where full suspension is not possible, yarding is limited to when the stream is dry (aquatic mitigation measure 10). These measures are in place to maintain at-risk species habitat located downstream in the sub-watershed.

Table 20. Skyline Corridors Through Stream Buffers and Proximity to Listed Fish Habitat

Unit	**Acres by Yarding System**			**Skyline Corridors Across Streams**			
				Perennial		*Intermittent*	
	Ground	*Skyline*	*Helicopter*	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
2	103	14	9	0	0	2*	No Connection
11	0	31	0	10	7,600	10	tributary to perennial stream
12	0	14	0	11	6,900	3	tributary to perennial stream
36	0	34	0	0	0	6	2,800
40	20	5	0	9 (Class 2)	6,200	0	0
45	15	20	0	10	11,000	4	tributary to perennial stream
47	0	29	0	7	13,800	0	0
51	0	18	0	2**	5,600	6**	tributary to perennial stream
82	0	26	0	6*	No Connection	0	0
84	0	20	7	0	0	3*	No Connection
85	0	0	11				
88	0	8	23	0	0	4*	No Connection
91	17	18	0	2*	No Connection	0	0
841	0	22	0	0	0	0	0
Total	747	931	458	57	__	38	___

* corridors over channel with no surface connection to the McKenzie River (LFH);
**corridors over channel upstream of Tokatee Golf Course and are tributary to a series of golf course ponds.

The use of low severity fire in older stand treatments of Bridge Thin project units is expected to present negligible risk to aquatic animals or habitat. Fire treatments consist of hand or machine piling of slash along roads and understory burning in spring-like conditions. Site conditions (when fuel moisture is sufficient to maintain duff and soil stability) would sufficiently protect aquatic resources in the project area. Potential to increase nutrient levels phosphorous and nitrate to channels increases with use of fire, however the level of nutrient delivery would not exceed the range of conditions approached during historic fire disturbance. Aquatic species have adapted to a more frequent fire disturbance regime than is currently provided in a managed forest landscape. Removal of duff through burning and exposure of soil to mobilization with precipitation is of very low risk. The potential to adversely affect aquatic biota or habitat is negligible; due to the distance fire is utilized is from the channel and low intensity of fire used in unit treatment.

Alternatives B and C—Cumulative Effects

The current road density in federally managed portions of the sub-watershed would remain near 4 miles per square mile as no new system roads are added and few are removed (0.3 mile) with the proposed project. Continuing rural residential development in the sub-watershed (approximately 40% privately owned) may be expected to increase, based on recent trends of private development. Greater development in non-federal portions of the sub-watershed may be expected to increase concentration of water from impermeable surfaces and increase fine sediment yield. Industrial timberland harvest rates are expected to continue at about a 40-year rotation and yield fine sediments at a relatively constant rate, supplied by private road networks and ground disturbance associated with timber management.

Maintenance of system roads in action alternatives is expected to withstand flood events through improved ditch relief drainage and up-sized stream culverts and may be expected to be more resistant to culvert related failure (compared to current condition). Action alternatives would result in a slight increase in sediment input (an additional 26 cubic yards per year) in the sub-watershed. The expected magnitude and duration of increase (the first fall storm following project activities) is of short duration and within the tolerance of native aquatic organisms to sustain or avoid the sediment increase. The range of conditions necessary for aquatic resources in the project sub-watershed is maintained in the short-term (with localized increases perceptible at the site scale) and increased slightly in the long-term.

With the limited extent of disturbance within riparian reserves in close proximity to stream channels associated with the project, existing aquatic habitat conditions are expected to be maintained. As described in previous effects discussion, project effects on shade and water temperature, sedimentation, and stream flows are expected to be negligible at the sixth field watershed scale. Site-specific disturbance may be expected to be of short duration (approximately 3 years, during timber harvest and haul activity) and of insufficient magnitude to place native aquatic organisms at risk.

Following examination of the cumulative effects of past actions, the proposed project, and reasonably foreseeable actions in the analysis are, the additional management-induced effects from this project would not change the following:

1. The timing or magnitude of peak flow events (planning sub-drainage ARP remain above the Willamette Forest Plan recommended levels);
2. Instability of stream banks (recommended ARP midpoints are exceeded, and exclusion of bank destabilizing activity);
3. Adverse alteration of the supply of sediment to channels (fine sediment supply would be localized and of short duration);
4. Adverse alteration of sediment storage and structure in channels (channel conditions would be maintained with proposed action alternatives).

Blue River and Cougar Dam fragmentation of aquatic habitat in the McKenzie continues to be a major influence on the aquatic landscape and plays a crucial role in at-risk species viability.

The Bridge Thin Project would not incrementally contribute to increased fragmentation of habitat. Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by Management Indicator Species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through population(s) access to historic refugia areas. Other projects are not foreseeable within the Bridge Thin Project area that would add cumulatively to past and current actions. Habitat conditions necessary to aquatic MIS species (spring Chinook salmon, bull trout, rainbow trout, cutthroat trout, brook lamprey) and ESA listed species (bull trout and spring Chinook) habitat in the upper McKenzie River are expected to be maintained within and downstream of the project area.

Magnuson-Stevens Fishery Conservation Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires the identification of habitat "essential" to conserve and enhance the federal fishery resources that are fished commercially. The Pacific Fishery Management Council (PFMC) designated Essential Fish Habitat (EFH) for Chinook, coho, and Puget Sound pink salmon in their Amendment 14 to the Pacific Coast Salmon Plan, issued September 27, 2000. The interim final rule implementing the EFH provision of the MSA (62 FR 66531) requires federal agencies to consult with the NOAA Fisheries Service for any action that may adversely affect EFH. Bridge Thin Project is located in the McKenzie River Watershed, which is included in the waters designated as EFH for spring Chinook salmon by the PFMC.

Potential downstream effects from timber harvest, road reconstruction, and fire treatments on EFH habitat for spring Chinook salmon is expected to be negligible due to treatment scale, low severity and proximity of activity to stream channels. Sources of sedimentation are expected to increase in the short-term at the site-specific level from the ground disturbing activity. These increases would result primarily from road reconstruction, culvert replacement, haul and temporary road construction. No stream crossing reconstruction would occur within bull trout or spring Chinook habitat. Habitat of importance to spring Chinook could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity. However, the distance of reconstruction activity and prevailing sub-surface water flow in the project area would substantially reduce the risk. Project effects are expected to be of short duration during seasons of implementation. Suspended sediments are not expected to adversely impact habitat important to spring Chinook due to low project scale and intensity, flow routes, distance of activity from listed species habitat, and use of best management practices.

As described above, project cumulative effects of past, current (Bridge Thin action alternatives) and foreseeable actions is expected to maintain EFH habitat within and downstream of the project area. The proposed action would not adversely affect aquatic systems, recreational fisheries, or designated Essential Fish Habitat. The effects that are likely to occur are based on sound aquatic conservation and restoration principles for the benefit of recreational fisheries, as directed by Executive Order #12962. Since the project would not adversely affect EFH, no further consultation under the Magnuson-Stevens Fishery Conservation and Management Act is required.

The No Action alternative would not adversely affect EFH habitat.

Endangered Species Act Consultation

The scale of analysis to address the direct, indirect, and cumulative effects on aquatic resources examined the McKenzie River/Elk Creek six-field watershed, evaluated at this scale due to the project footprint and potential effects of project activity downstream. The proposed action was evaluated for potential project effects on the Matrix of Indicators found within the Fisheries Biological Assessment (EA appendices).

These indicators are Temperature, Sediment, Large Woody Material, Peak/Base Flows, Road Density, Disturbance History, and Riparian Reserves. Potential effects occur primarily as a result of timber harvest, road reconstruction, haul and fire treatments. Effects from the proposed action are expected to be negligible due to treatment scale, low severity and proximity of activity to stream channels (as direct and indirect effects).

Short-term increase in sources of sedimentation is expected to occur at the site-specific level from ground disturbing activity. These short-term increases are primarily the result of road reconstruction, culvert replacement, timber haul and fire treatments. The absence of stream crossing reconstruction in the vicinity of listed species habitat is expected to maintain Critical Habitat for bull trout and spring Chinook salmon. Habitat of importance to spring Chinook could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity. However, the distance of reconstruction activity and prevailing sub-surface water flow in the project area substantially reduce the risk.

Action alternatives produce effects that are expected to be of short duration during seasons of implementation. As described above, the cumulative effects from this proposal are expected to maintain listed species and their habitat within and downstream of the project area. Implementing Alternative A (No Action) would not adversely affect listed species or adversely modify their habitat.

ESA informal consultation was originally completed with the receipt of a letter of concurrence from USFWS (ref. number 1-7-05-I-0025; date 02/07/2008) agreeing with the Forest Service determination that the proposed action was Not Likely to Adversely Affect bull trout, and it would have no adverse modification of Critical Habitat. A letter of concurrence from NMFS agreeing with the Forest Service determination that Bridge Thin Project (Alternative B, proposed action) was Not Likely to Adversely Affect spring Chinook salmon is forthcoming. No decision will be made concerning the Bridge Thin project until a letter of concurrence from NMFS is received. The quality of Critical Habitat important to listed aquatic species, including spring Chinook salmon and bull trout, is expected to be maintained with implementation of the proposed action or any action alternative.

Threatened Northern Spotted Owl (Significant Issue #2) _____

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for threatened northern spotted owl was a 2.4 mile buffer around all project units that may change habitat conditions for the spotted owl. The analysis area is within the H.J. Andrews northern spotted owl demographic study area and monitoring of owl populations have occurred since 1987 (Anthony et al. 2006). There are nineteen known activity centers within the Analysis Area. Occupancy modeling by USFWS predicted no new home ranges undetected by surveys so all the effects analysis are based on survey data. Seven spotted owl home ranges overlap project units.

Affected Environment—Threatened Northern Spotted Owl

The northern spotted owl is considered a Management Indicator Species (MIS) for old growth habitat in the Willamette Forest Plan p. IV-160 (USDA Forest Service. 1990). Past surveys for spotted owls have documented seven spotted owl activity centers within 1.2 miles of the Bridge Thin Project. All seven spotted owl activity centers have established, 100-acre late successional reserves.

Challenges to spotted owl conservation exist range-wide, which includes potential threats from wildfires, barred owl competition, great horned owl predation, West Nile Virus and sudden oak death. A detailed discussion of these potential threats can be found in the Biological Assessment in Appendix D. Disturbances on the landscape from wildfires and wind storms have affected spotted owl habitat. Loss and fragmentation of suitable spotted owl habitat and other interior forest species habitat in this planning area have had detrimental effects on these species. Fragmented habitat increases flight distance and energy consumption for foraging, and increases habitat suitability for predatory and competitive owls such as the great horned and barred owls. This fragmentation may increase spotted owl mortality, especially for juveniles.

The U.S. Fish and Wildlife Service has determined that reduction of suitable spotted owl habitat below 40% of the median home-range (1,182 acres) has a notably higher likelihood of leading to disruption of essential breeding, feeding, and sheltering behaviors (USDI Fish and Wildlife Service, 1992). A 1.2-mile radius around the activity centers defines the median home range. Three of the seven known activity centers in the Bridge Thin Project area are currently above the 40% habitat threshold.

Suitable spotted owl habitat has been defined in various documents: The ISC Report, USFWS Critical Habitat Determination, Memorandum Decision and Injunction for Judge Dwyer's Decision, and the FSEIS on Management of the Northern Spotted Owl in the National Forests. General guidelines for suitable spotted owl habitat are forested stands of Douglas fir , Western hemlock, Western redcedar, or Ponderosa pine older than 200 years and having a moderate to high canopy closure of 60-80%. An understory of multi-layered conifers and hardwoods open enough to still allow owls to fly within and beneath it, moderate to high snag densities, and large logs are also found in typical spotted owl habitat. However, all of the above characteristics do not need to be present for spotted owls to make use of an area, and for habitat to be determined suitable.

Dispersal habitat typically would not have the large, old-growth nest trees, multi-layered canopy, or many large snags and logs. The minimum canopy closure for dispersal habitat is 40%.

Past logging activities in the Bridge Thin Project area has removed many acres of spotted owl habitat. Remaining suitable habitat in the project area is now highly fragmented, lowering the overall quality of habitat on the landscape.

Environmental Consequences—Threatened Northern Spotted Owl

The Bridge Thin Project would not downgrade or remove existing suitable spotted owl habitat, which consists of nesting, roosting, and foraging habitat. Dispersal habitat would be modified and removed; however, dispersal habitat is not limited within and between home ranges in the project area. The following definitions apply to these terms:

- **Downgraded:** to alter the functionality of spotted owl suitable habitat so that the habitat no longer supports nesting, roosting, and foraging behavior. This downgrading of habitat can result when the canopy and understory are thinned yet still retain a minimum of 40% average canopy closure.
- **Removed:** to alter suitable spotted owl habitat so that the habitat no longer supports nesting, roosting, and foraging behavior. In addition, to alter dispersal habitat so that canopy cover results in less than 40 percent and no longer functions as dispersal habitat.

Effects on habitat are in compliance with Standards and Guidelines from the Willamette National Forest Plan and U.S. Fish and Wildlife Service guidance. All sites at risk from noise disturbance would be protected with seasonal restrictions. Eleven of the proposed project units are located in Critical Habitat and none within Late Successional Reserves.

Informal consultation with the U.S. Fish & Wildlife Service for effects to the northern spotted owl was initiated in October 2007 with a Biological Assessment submitted on January 10, 2008. This Biological Assessment (Appendix D) contains an analysis of spotted owls including effects of project related activities as well as new information and potential threats. A letter of concurrence dated 02/07/2008 was received from US Fish and Wildlife Service that concurred with the Biological Assessment that the Bridge Thin project may affect but is not likely to affect the northern spotted owl or its critical habitat.

Alternative A (No Action)—Direct, Indirect, Cumulative Effects

Under this alternative, no actions would be implemented to changes spotted owl breeding or dispersal habitat. Forest stands in the area would continue to grow following natural successional pathways. Fragmented forest blocks would aggregate into contiguous forest over time. Trees within younger stands would thin out naturally over a span of several decades, and may reach low quality spotted owl foraging habitat suitability in approximately 50 or more years. Due to the previous clearcuts and relatively tight spacing in plantations, trees would grow slower in diameter than if thinning were to occur. Self-thinning would take place over time mostly due to tree competition, some wind throw, and possibly from root rot over time. Down wood would be provided as tree mortality occurs, which contributes to maintaining the spotted owl prey base.

There are no ongoing or reasonably foreseeable activities planned on Forest Service land in the analysis area. The habitat condition of private ground within the affected home ranges as shown in (Table 8 of Appendix D) is almost entirely non habitat for owl sites 0104, 2034, and 2836. For owl sites 0856 and 2443 the habitat condition is approximately 70% and 80% non habitat respectively with the remaining acres likely to be harvested into non habitat in the foreseeable future, given current private timber ground harvest practices. The project analysis assumes that private lands are all non-habitat for spotted owls. Owl sites 0029 and 2422 have no private ground within their designated home ranges.

Alternative B—Direct and Indirect Effects

With alternative B, no suitable spotted owl habitat would be downgraded or removed. Fuel reduction treatment in units 101 and 103 would remove non-commercial material less than 7" in diameter on 38 acres of suitable spotted owl habitat. These 38 acres would remain suitable habitat. Heavy thinning would occur on 228 acres of dispersal habitat and result in a post treatment canopy closure below 40 percent. The canopy closures of these stands are expected to grow at a rate of approximately 1% per year and return to the 40 percent threshold within 8-10 years (Chan et al 2006) An additional 10 acres (unit 80) of dispersal habitat would be removed below 40 percent canopy closure and 38 acres (within units 84, 85, and 86) of oak thinning treatment

Alternative C—Direct and Indirect Effects

With alternative C, no suitable spotted owl habitat would be downgraded or removed. Fuel reduction treatment in units 101 and 103 would remove non commercial material less than 7" in diameter on 38 acres of suitable spotted owl habitat. These 38 acres would remain suitable habitat. Heavy thinning would occur on 218 acres of dispersal habitat and result in a post treatment canopy closure below 40 percent. The canopy closures of these stands are expected to grow at a rate of approximately 1% per year and return to the 40 percent threshold within 8-10 years (Chan et al 2006). An additional 38 acres (within units 84, 85, and 86) of oak thinning treatment would remove dispersal habitat.

Alternatives B and C—Cumulative Effects

The analysis area chosen for considering cumulative effects on spotted owls was a 2.4 mile buffer around all project units that may change habitat conditions for the spotted owl.. Seven spotted owl home ranges overlap proposed project activity units, and the analysis of a Timber sales have occurred on approximately 3,711 acres within the Bridge Thin Project area under USFS management since the 1940s (see Table 13). This represents about 31% of the 11,961 acres under USFS management in the project area.

The Biological Assessment found in Appendix D contains a detailed analysis of spotted owls. A summary of cumulative effects considering private lands is included here. The habitat condition of private ground within the affected home ranges as shown in (Table 8 of Appendix D) is almost entirely non habitat for owl sites 0104, 2034, and 2836. For owl sites 0856 and 2443 the habitat condition is approximately 70% and 80% non habitat respectively with the remaining acres likely to be harvested into non habitat in the foreseeable future, given current private timber ground harvest practices. The project analysis assumes that private lands are all non habitat for spotted owls. Owl sites 0029 and 2422 have no private ground within their designated home ranges.

Past timber harvest has resulted in the removal or fragmentation of many acres of suitable spotted owl habitat, but some of the previously managed stands are currently providing dispersal habitat. Many stands are too young and have too small a diameter to be considered dispersal habitat at this time, but they would grow into dispersal habitat over time.

Alternative B, the proposed action, would not remove spotted owl habitat but it would reduce fuels on less than 7" diameter on 38 acres, and remove 228 acres of dispersal habitat. The USFWS has concluded that this proposed action, the Bridge Thin Timber Sale, would not jeopardize the continued existence of the spotted owl.

There are no reasonably foreseeable future actions identified which could alter suitable habitat and incrementally contribute to the cumulative effects of past actions and the proposed actions.

Big Game Habitat- (elk and deer) ________________________

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Big Game Habitat includes the project activity units and three Big Game Emphasis Areas (BGEA) where management activities would occur. The BGEAs were used for the scope of analysis because of the established ratings for elk habitat that is described for the BGEAs in the Willamette National Forest. The BGEAs do not include private lands.

Affected Environment—Big Game Habitat

The Bridge Thin planning area has three designated Big Game Emphasis Areas (BGEA): Florence, Taylor, and Minor Tributaries (See Figure 26). The areas are designated as High, Moderate and Low Emphasis respectively. These areas are managed for elk habitat under guidance from the Willamette Forest Plan Standards and guidelines (FW-137) with the assumption that providing high quality elk habitat would adequately address the needs for black-tailed deer.

Elk Model for Bridge Thin Project Area

<u>A Model to Evaluate Elk Habitat in Western Oregon</u> (Wisdom, 1986) is used to estimate habitat effectiveness (HE), which is defined as the proportion of achievement relative to an optimum condition. The management intent is to maintain effectiveness within a range of values with the optimum value being 1.0. HE incorporates and qualifies four key habitat attributes; size and spacing of forage (HEs), quality of forage (HEf), cover areas (HEc), and open road density through elk habitat (HEr). Each habitat variable is calculated individually and allows for a comparison by variable or as a whole (HEI). The elk model considers past and ongoing activities and results in an evaluation of the cumulative impacts on habitat from the past, present, and foreseeable future actions in the Big Game Emphasis areas.

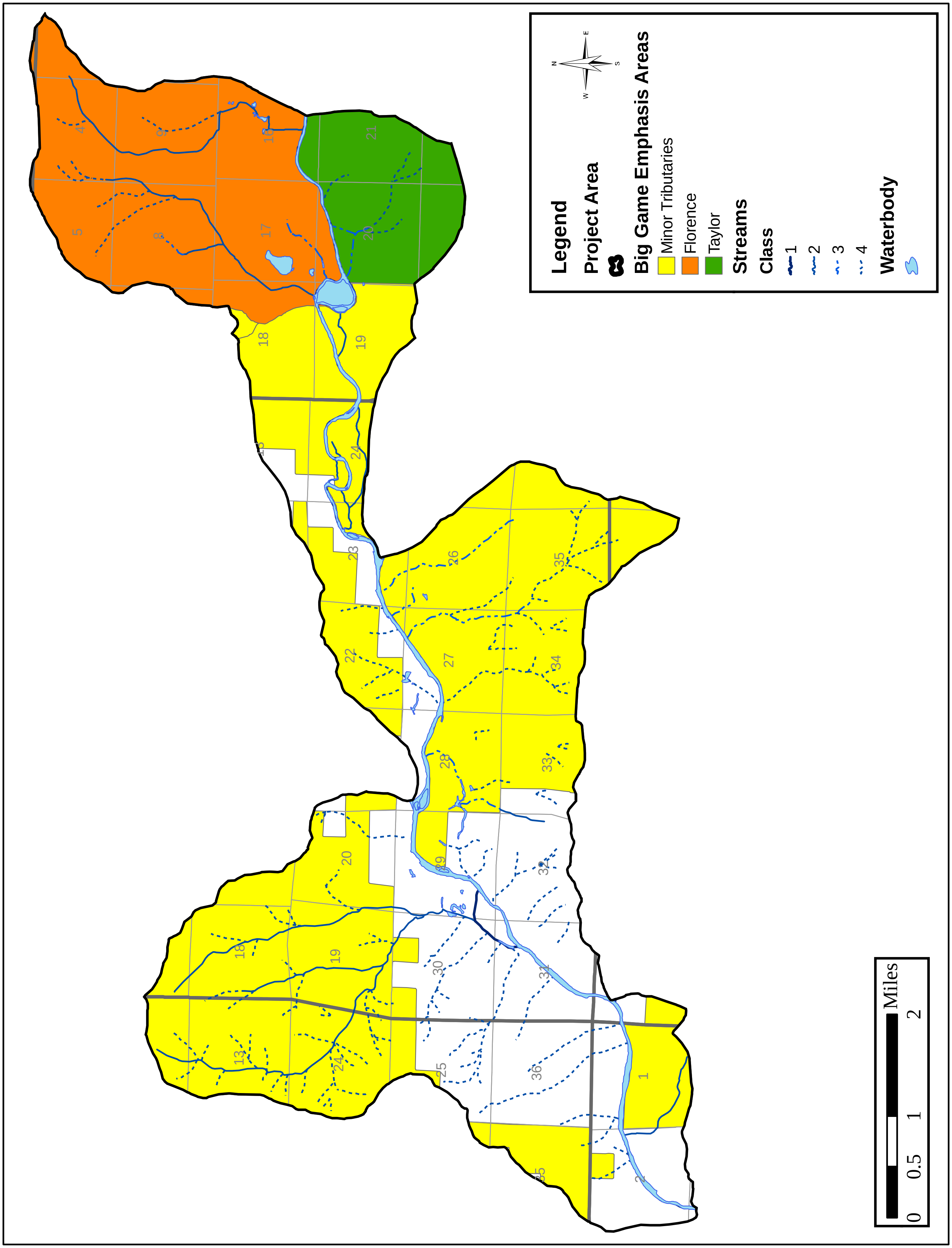


Figure 26. Big Game Emphasis Area map.

Maintaining a balance between cover and forage areas is a key component of elk habitat management in the Wisdom model. Using tightly controlled experimental conditions, Cook et al (1998) found that thermal cover did not enhance elk survival and production, was not required by elk where food was not limiting, and could not compensate for inadequate forage conditions. Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, and population growthand stability (Cook et al. 2004). The increased importance of available forage abundance and quality compared to thermal cover has also been supported by nutritional and physiological studies of black-tailed deer (Parker et al. 1999).

The Wisdom model was developed to evaluate landscape areas where quality forage areas were provided primarily by clear cutting and associated post-harvest burning and fertilization. With the dramatic decline in regeneration timber harvest under the Northwest Forest Plan, there has been a corresponding decline in high-quality elk forage habitat. This trend, coupled with recent studies, has increased the importance of providing foraging habitat for elk on the Forest. A drawback of the Wisdom model is that forage is evaluated based on the average value of defined forage areas and does not consider the amount of forage provided. Areas that do not provide meaningful forage are not considered in the forage effectiveness calculations. Consequently, providing substantial acres of temporarily improved elk and deer forage conditions by commercial thinning may result in a lower forage score in the Wisdom model if these acres lower the average value for forage areas in the landscape. Published research support the idea that increasing the amount of available forage by commercial thinning should improve the overall habitat conditions for elk and deer within the analysis area regardless of the average forage value derived from the Wisdom model.

Table 21 displays the current condition of habitat values for patch size and spacing (HEs), open road density (HEr), cover quality (HEc), forage quality (HEf), and overall habitat quality (HEI) that existed for big game habitat when watershed analyses were conducted for these areas.

Table 21. HEI Analysis for Big Game Habitat in the Bridge Thin Project Area

BGEA Name	BGEA Emphasis Level	Results for Each Model Variable Indices				
		HEs	HEr	HEc	HEf	Overall HEI
Florence	High	0.71	0.41*	0.50	0.33*	0.47*
Taylor	Moderate	0.37*	0.57	0.33*	0.45	0.42
Minor Tribs	Low	0.49	0.56	0.73	0.53	0.56

* Values are below recommended minimum threshold levels
Willamette NF Land Management Plan Standard &G Target Level:
High Level BGEA Individual Index: >0.5 Overall index: >0.6
Moderate Level GBEA Individual Index: >0.4 Overall Index: >0.5
Low Level GBEA Individual Index: >0.2 Overall index: increase any variable <0.2

Summary of Existing Elk Model Variables for the BridgeThin Project Analysis Area
• **Size and Spacing of Forage**: The size and spacing habitat effectiveness rating (HEs) for forage and cover in two elk emphasis areas indicates that the existing distribution of cover and forage is very good and that management goals for size and spacing are currently being met for Florence (0.71) and Minor Tribs (0.49). The size and spacing for Taylor (0.37) is currently below Forest Plan recommendations.
• **Road Density:** Road densities in two areas are currently adequate with HEr values of Taylor (0.57) and Minor Tribs (0.56). Road densities in the Florence (0.41) area is currently below Forest standards.
• **Cover:** The habitat effectiveness value for cover (HEc) in the Florence (0.50) area and the Minor tribs (0.73) area are currently meeting the Forest Plan standards. The Taylor (0.33) emphasis area is currently below Forest Plan standards.
• **Forage:** The forage quality habitat effectiveness rating (HEf) for Taylor (0.45) and minor Tribs (0.53) are currently meeting Forest Plan standards. The Florence (0.33) area is currently below Forest Plan standards for forage quantity and quality.
• **Habitat Effectiveness Index (HEI):** The overall ratings of (HEI) indicate that two emphasis areas are currently above Forest plan standards: Taylor (0.42) and Minor Tribs (0.56). The overall HEI rating for Florence (0.47) is currently below Forest Plan standards.

Forage, Hiding, Thermal and Optimal Thermal Habitat, and Road Densities

Past harvest activities have shaped the landscape in terms of the juxtaposition and types of elk habitat. Harvest treatments were primarily regeneration, including clearcuts and shelterwoods. These harvested units once provided a wealth of quality forage for elk but have since grown into hiding and thermal cover. No specific data are available for the local elk/deer population within the three BGEAs for this project. Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Recent ODFW elk population estimates show that state management unit in the vicinity of the project area (McKenzie) have elk herds with population numbers near their current management objectives (Bill Castillo pers com; ODFW 2005).

Environmental Consequences—Big Game Habitat

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Current trends of elk habitat development would continue to occur naturally over time with Alternative A. Existing elk foraging habitat is expected to continue growing into hiding cover and then to thermal cover. Thermal cover would continue to grow toward optimal thermal cover. There would be no change to the current elk effectiveness ratings.

In ten years, forage availability would be expected to decrease in this area as current openings succeed into hiding cover. In the absence of additional harvest or wildfire, no new foraging areas would be created. The current optimal and thermal cover would not significantly change.

In 50 years, approximately 30% of the existing thermal cover would shift into optimal thermal cover. Hiding cover would succeed into thermal cover. Road density and big game security would not change. Overall habitat quality may decrease from the loss of forage. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on big game habitat.

Alternatives B and C—Direct and Indirect Effects

The proposed thinning (approx 2,256 acres) and prescribed burning (approx 1,300 acres) for the Bridge Thin project would change the function of big game habitat from thermal cover to: either lower quality thermal cover, or hiding cover or foraging. Alternatives B and C propose 190 acres of wildlife thinning, intended to increase big game forage in the heart of the high emphasis Florence area where forage quality are currently lacking. In addition unit 80 (10 acres) in Alternative B only would propose a forage area intended for repeated underburning and manual treatment to maintain forage production. The proposed oak savanna treatments would restore approximately 30 acres of historic open oak savanna habitat with a dominated grassy forage understory. The remaining acres for the Bridge Thin project would provide a limited short-term (<5-6 years) benefit to forage from light to moderate thinning until the tree canopies close in as a result of tree crowns responding to reduced competition for sunlight. Road densities would not measurably change with the Elk Model with 0.2 miles of additional roads being closed with this project.

Alternatives B and C—Cumulative Effects

Past management activities initially resulted in an abundance of forage habitat with the many acres of regeneration harvesting that occurred. The more recent lack of regeneration harvest has allowed these forests to grow into hiding and thermal cover to create the current condition represented by the no action alternative in the Table 21. The overall impact of the proposed action is that thermal cover in the treated stands would be changed to lower quality thermal cover, or hiding cover or forage. There are no foreseeable actions that would modify habitat in these BGEAs.

Alternatives B and C—Conclusions

Proposed activities would increase habitat quality for elk and deer in all three BGEA emphasis areas. Open road densities would not measurably change. Forage quality would definitely increase on 233 acres in Alternative B and 223 acres in Alternative C. Beneficial effects to big game forage from thinning and prescribed burning proposed by this project are not significant in scale and are not expected to be reflected in individual or overall habitat effectiveness values in the elk model given the majority of acres in a thermal cover classification. A limited number of animals would benefit from the small-size openings that would be created by the project, so there would be little potential for any noticeable population response as a result of the proposed actions. Project effects to big game are essentially unquantifiable on an individual basis relative to the amount of habitat modified or disturbed against the amount available to these species on a daily basis in the affected BGEAs. Direct and indirect effects are largely limited to potential temporary displacement of individuals during implementation of proposed activities in big game habitat. Short and long-term increases in forage habitat would be evident within the project area. In the context of the BGEAs, and adjacent 5th field watersheds, project effects would result in a minor contribution to cumulative effects that have already occurred from past management actions surrounding the project area. Given what is currently known about local deer and elk populations, the future viability of these species should be assured as long as habitat restoration opportunities continue to be implemented – especially when conducted at an appropriate scale.

Sensitive Species

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Threatened, Endangered, and Sensitive Species includes the project activity units and Forest Service lands within the McKenzie River/Elk Creek 6th Field sub-watershed.

Affected Environment—Wildlife

Sensitive species have specific requirements under the Willamette National Forest Plan to maintain viability. Protection includes managing habitat to minimize impacts, as well as prohibition of noise disturbance during the breeding season.

Table 22 lists the sensitive wildlife species on the Willamette National Forest (USDA Forest Service, 2004) and whether there is potential habitat in the planning area. Additional detailed information about these species is in Appendix D Biological Evaluation for Wildlife.

Table 22. Potential for Occurrence of Sensitive Species in the Project Area.

Species	Habitat Present in the Bridge Thin Project Area?
Amphibians and Reptiles	
Oregon Slender Salamander	Yes
Cascade Torrent Salamander	No
Foothill Yellow-legged Frog	No
Oregon Spotted Frog	No
Northwestern Pond Turtle	No
Birds	
Least Bittern	No
Bufflehead	No
Harlequin Duck	Yes
Northern Bald Eagle	Yes
American Peregrine Falcon	Yes
Yellow Rail	No
Black Swift	No
Tri-colored Blackbird	No
Mammals	
Baird's Shrew	No

Species	Habitat Present in the Bridge Thin Project Area?
Pacific Shrew	No
Wolverine	Yes
Pacific Fisher	No
Pacific Fringe-tailed Bat	Yes
Mollusks	
Crater Lake Tightcoil	Yes
Invertebrates	
Mardon skipper	No

Environmental Consequences—Wildlife

Alternative A—Direct, Indirect, and Cumulative Effects

Under this alternative, no actions would be implemented to change sensitive species breeding, foraging or dispersal habitat. Forest stands in the area would continue to grow following natural successional pathways. Fragmented forest blocks would aggregate into contiguous forest over time. Trees within younger stands would thin out naturally over a span of several decades. Due to the previous clearcuts and relatively tight spacing in plantations, trees would grow slower in diameter than if thinning were to occur. Self-thinning would take place over time mostly due to tree competition, some wind throw, and possibly from root rot over time. Down wood would be provided as tree mortality occurs. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on sensitive wildlife species.

Alternatives B and C—Direct and Indirect Effects

Bridge Thin Alternatives B and C meet all applicable Standards and Guidelines from the Willamette National Forest Plan and the Northwest Forest Plan Standards and Guidelines. Under Alternatives B and C, changes in the amount or characteristics of required habitat for these species would be minimal and therefore maintain persistent populations of sensitive species.

Potential effects and impacts of alternatives of the Bridge Thin Project for sensitive wildlife species, and fish can be found in the Biological Evaluations in the Appendix D.

Alternatives B and C—Cumulative Effects

The wildlife species listed as MIS for the Willamette National Forest and present in the project area, are discussed elsewhere in this EA. Cumulative effects on deer and elk are also discussed above. There would be minimal additional incremental effects from the proposed action or alternatives actions, on sensitive species or their habitat within the project area, when considering the effects from all past actions. There is no foreseeable future habitat management actions planned within the Bridge Thin project area that would add to the cumulative effects of the past and currently proposed actions or action alternatives

Affected Environment— Sensitive, Rare, and Uncommon Plant Species

The Forest Service manual gives direction to ensure the viability of sensitive botanical species as well as preclude trends toward endangerment that would result in the need for Federal listing (Forest Service, 1991). There are no listed Threatened or Endangered plant species on the Willamette National Forest. Other rare plants, often not associated with older forests, are compiled on the Regional Forester's Sensitive Species List for the Willamette National Forest. These species and their habitats are often rare and limited in distribution.

During the early stages of project development, a pre-field review determined which sensitive species occur in the Bridge Thin Project area. From there, intuitive-controlled field surveys conducted during June and July of 2007 investigated potential habitat of sensitive plants. The pre-field review identified populations of *Cimicifuga elata* and *Romanzoffia thompsonii*. Aside from the aforementioned sensitive plants, the subsequent surveys identified 2 additional sensitive lichen species, and at least 15 unique special habitats in the Bridge Thin project area. See Table 23

Table 23. Sensitive Species in the Bridge Thin Project Area

Proposed Units	Sensitive Species	Buffer
2	*Cimicifuga elata*	180 ft.
86	*Romanzoffia thompsonii*	180 ft.
3, 26, 95	*Peltigera pacifica*	180 ft.
80, 95	*Usnea longissima*	180 ft.

Environmental Consequences—Sensitive, Rare, and Uncommon Plant Species

Alternative A—Direct, Indirect, and Cumulative Effects

This alternative would have some direct or indirect effect on sensitive plants or rare botanical species. Although there would be no ground disturbance or disturbance of the microclimate with this alternative, selecting Alternative A may affect certain species of sensitive fungi. Specifically, without management action, downed wood accumulation would likely increase over time and stands would become more at risk for high intensity fires. Landscapes with heavy fuel loads are at greater risk of high-intensity, stand replacing fire, which is more likely to sterilize the soil, thus destroying fungal spores and mycelium found in organic mater on the surface and uppermost soil horizons. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on sensitive, rare, and uncommon plants.

Alternatives B and C—Direct and Indirect Effects

The action alternatives would have no direct or indirect effects on sensitive plants or rare botanical species. All known sensitive plant occurrences would be protected with a 180 ft. no-disturbance buffer to maintain the viability of the populations. The buffer would maintain the microclimate for those species requiring cover or moisture retention and aid in protecting other species from physical damage during project implementation. This buffer applies to all harvest activities, ground disturbing activities, and fuels treatments. For further discussions on botanical species, see the Botany Biological Evaluation and Resources report in Appendix C.

It is also noted that fungi are difficult to identify in the field, often requiring chemical and microscopic spore analysis. Apart from taxonomy, fungal relationships in ecosystems and seemingly sporadic fruiting from year to year add to the complexity of fully understanding these organisms. As a result, there are no reliable survey methods to locate most fungi populations. Therefore, there are likely fungi populations in the Bridge Thin project area that are currently unidentified.

Indirectly, canopy removal would have the most impact to fungi that are sensitive to microclimatic change. Subsequent slash pile/fuels treatments have potential to affect some fungi species in Bridge Thin units. Despite limitations in survey reliability, the risk of the proposed project activities endangering the viability of sensitive fungi species is low.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for sensitive and rare botanical species is the Forest Service lands within the Bridge Thin Project area. This area was chosen because activities outside the analysis area would have no effect on sensitive species or other rare botanical species potentially located within the project analysis area.

Implementation of Alternatives B or C would not have measurable cumulative effects on sensitive plants in the project area because of the no-disturbance mitigation and the lack of reasonably foreseeable future activities in the analysis area. Based on the analysis of this project there would be no incremental change to existing populations of sensitive species or other botanical species in the project area due to selecting any alternative detailed in the Bridge Thin Project EA.

Affected Environment—Special Habitats

Special habitats are non-forested habitats that are limited in size and distribution across the landscape. It is important to consider the biological diversity and ecosystem function of these small, scattered habitats for a number of reasons. Special habitats often play important roles for full-time wildlife residents of the sites, as well as for those who use them seasonally, or for only a portion of their lives. Special habitats also serve as potential habitat for many other plants on the Regional Forester's Sensitive Species list.

Numerous factors contribute to the creation or maintenance of special habitats. Among such factors, topography and hydrology often determine the microclimatic conditions at these sites.

A unique mix of special habitats and sizes were located in the Bridge Thin Project area during the summer 2007 surveys. They range in size from one-half acre up to 6 acres. Sensitive plant populations also exist in or adjacent to four documented special habitats in the project area. See Table 24 for locations of special habitats documented in the Bridge Thin Project area and the buffer sizes recommended in the Willamette National Forest Special Habitat Management Guide (J. Dimling, C.McCain, 1996).

Table 24. Special Habitats in the Bridge Thin Project Area

Proposed Units	Special Habitat	Buffer
26	Swamp	1 acre
95	Swamp	1 acre
95	Pond	1 acre
3	Pond	1 acre
85	Dry meadow	NA- underburn proposed/exposure recommended
86	Dry meadow	NA- underburn proposed/exposure recommended
31	Dry meadow	180 ft.
32	Rock outcrop	180 ft.
32	Dry meadow	180 ft.
80	Dry meadow (Usnea site)	1 acre
35/36	Dry meadow	180 ft.
37	Dry meadow/rock outcrop openings	½ acre around cluster
6	Rock outcrop	180 ft.
29	Swamp	1 acre
15	Rock outcrop	100 ft. around cluster
56	Rock outcrop and seep/wet meadow	180 ft.
11/ 12	Mesic meadow	180 ft.
43	Swamp/seep	180 ft. each
91	Swamp	1 acre

Environmental Consequences—Special Habitats

Alternative A—Direct, Indirect, and Cumulative Effects

Selecting the No Action alternative would allow for the same level of special habitat management annually programmed. This alternative would have no effect on special habitats. Alternative A would have no direct, indirect, or cumulative effects on special habitats in the project area

Alternatives B and C—Direct and Indirect Effects

The action alternatives would have no direct or indirect impact on special habitats. Special habitats would be buffered from harvest and ground disturbing activities. These buffers would maintain the microclimate, hydrology, and prevent damage to the areas during project implementation.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for special habitat is the proposed activity units within the Bridge Thin Project area. This area was chosen because activities outside the analysis area would have no effect on special habitats located within the project analysis area.

Implementation of the proposed action or any action alternatives would have no cumulative effects on sensitive plants in the project area because of the no-disturbance mitigation and the lack of reasonably foreseeable future activities in the analysis area. Based on the analysis of this project there will be no incremental change to existing populations of special habitats in the project area as a result of selecting any alternative detailed in the Bridge Thin EA.

Migratory Land Birds

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Migratory Land Birds includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Migratory Land Birds

Altman and Hagar (2007) identify 93 bird species in the Pacific Northwest that regularly breed in conifer forests less than 60 years of age. Over half of these species are experiencing population declines. Thinning generally does not change habitat conditions so dramatically that bird species can do longer use the stand, but often temporarily increase or decrease bird abundance depending on species. Altman and Hagar (2007) summarize studies showing 21 species of migratory birds whose range overlaps the project area increasing in abundance following forest thinning treatments. Seventeen migratory bird species did not changed in abundance or had mixed responses in forests that were thinned, while 7 species generally decreased in abundance, at least temporarily, after thinning. Silvicultural treatments that promote understory shrub development, trees species diversity, deciduous trees, and the growth of larger trees; maintain snags and downed logs; and create gaps in the stand generally improve avian biodiversity in the stand. Thinning has not been shown to have long term effects on any sensitive bird species or species of special concern.

Environmental Consequences—Migratory Land Birds

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A does not propose management activities at this time and therefore would not alter habitat conditions for migratory landbirds. Existing vegetation conditions would continue to follow natural successional pathways, and bird populations would respond accordingly. No snag habitat used by certain species of migratory land birds would be lost from roadside hazard tree removal. Additional snag habitat would occur through natural mortality in forest stands currently at low densities. Alternative A would have no direct, indirect, or cumulative effects on habitat of migratory landbirds in the project area

Alternatives B and C—Direct and Indirect Effects

Felling of trees associated with this project may unintentionally affect habitat for individual migratory birds, but is not expected to have a measurable effect on habitat because of the limited extent of habitat removal. Thinning and removal of stands may impact habitat for certain species such as Hutton's vireo, golden-crowned kinglet, hermit thrush, and Swainson's thrush by reducing suitable habitat. There would be areas of no harvest, such as riparian buffers, within some of the proposed stands providing structural variability and potentially less impact.

Species that use early seral-stages, such as the winter wren, American robin, and grouse, may benefit from thinning harvest. Species which would increase in number, as a result of thinning would include Dark-eyed junco, Warbling vireo, American robin, Hairy woodpecker, Townsend's solitaire, Evening grosbeak, Western tanager, and Hammond's flycatcher (Hayes, J. et al. 2003).

Some snag habitat used by migratory birds such as western bluebirds or swallows, would be lost due to roadside hazard tree removal under Alternatives B and C.

Alternative B—Direct and Indirect Effects

Alternative B would impact migratory landbird habitat by by thinning 2,256 acres of forest stand habitat. This alternative would include more acres of thinning and low intensity underburning than the other alternative. Those species that would be less affected as a result of moderate thinning, compared to heavy thinning, include Pacific-slope flycatchers, Hutton's vireos, and brown creepers (Hayes, J. et al. 2003). No old-growth habitat will be treated with this project.

Alternative C—Direct and Indirect Effects

Alternative C would impact migratory landbirds by thinning 2,080 acres of young forest stand habitat. Those species, which would be impacted more as a result of heavy thinning, compared to moderate thinning, include Pacific-slope flycatchers, Hutton's vireos, and brown creepers (Hayes, J. et al. 2003). It is expected that habitat for these species would increase once canopies close back in. bird species.

Alternatives B and C—Cumulative Effects

Past management activities within the Bridge Thin Project area have resulted in changes to the seral stage composition across the landscape altering habitat conditions for landbirds. Different species occupy different seral stage habitats and therefore the effects to habitat for each species depend on the type of change that occurred. The effects from the proposed harvest activities in the Bridge Thin Project area would be an increase in the acres of openings created across the landscape, which may impact some landbird habitat by reducing suitable, dense nesting habitat in very young trees. The more open nature of the remaining young trees may make nests more available to landbird nest predators, i.e. Stellar's jays or ravens. There are no other reasonably foreseeable future timber harvest activities for the project area.

Snags and Down Wood

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Snags and Down Wood includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Snags and Down Wood

The significance of the ecological role of snags and down wood in influencing ecosystem diversity and productivity is well addressed in the Willamette National Forest Land and Resource Management Plan (1990) and elsewhere (Brown et al. 2003). The significance of this relationship in coniferous forests of the Pacific Northwest is further emphasized by management Standards and Guidelines (S&G) under the Northwest Forest Plan ROD (1994, 2001) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Laudenslayer et al. 2002, Lewis 1998, Muir et al. 2002, Rose et al. 2001).

Under the Willamette Forest Plan as amended by the ROD, snag habitat shall be managed at levels capable of providing for at least 40% or greater potential populations of cavity-nesting species. Current science has tested the validity of the potential population approach to species management, yet it remains the basis for S&Gs (Standard and Guidelines) involving snag management. Strong support for identifying more appropriate amounts of snag and down wood habitat has resulted in the development of new approaches in addressing these habitat components. One such approach is DecAID - the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon (Mellen et al. 2006). DecAID has been created to help managers decide how much dead wood to provide for this part of a species habitat needs, and is designed to apply to salvage and green tree projects. A benefit of using DecAID during the planning process is that it determines if current dead wood levels are consistent with reference conditions. In addition, DecAID can be applied to identify dead wood management goals for projects that affect dead wood habitat throughout dominant habitat types. Snag and dead wood habitat levels were compared to DecAID recommendations and Forest Plan S&Gs based on population potential for this project

Interpretation and/or application of advice obtained from DecAID, pertaining to how the Bridge Thin Project may affect dead wood habitat is based on referencing information available in DecAID for the Westside Lowland Conifer-Hardwood habitat type in the Western Oregon Cascades with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). The Bridge Thin Project is predominantly within this habitat type. All stands proposed for commercial thinning harvest are within this habitat type, and the Bridge Thin Project planning area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006).

Snags (Current Condition)

Estimates for current snag size and distribution are displayed in Table 25, and were made based on estimates from a combination of stand exam data, knowledge of previous snag creation activity and field reconnaissance. Snag levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). Current snag levels throughout the planning area are above average values of the 50% tolerance range representative for snags in unharvested areas in this habitat type and condition.

Table 25. Current Condition (Alternative A- No Action) and Estimated levels of Snag Habitat for Alternatives B and C in Comparison with DecAID

Snag Size	Current Snag/Acre	DecAID- WLCH_OCA_S	
		Un-harvested inventory plots (unthinned managed stands)	All inventory plots (previously thinned and unthinned managed stands)
≥10" dbh	≈≥13 snags/acre	66th percentile	85th percentile
≥20" dbh	≈≥6 snags/acre	67th percentile	83rd percentile

The majority of large standing snags are Douglas fir . The majority of smaller snags throughout the area is also Douglas fir , and is a result of mortality from growth competition. Snag distribution across the project area can be considered patchy and variable, and would be affected equally under either Action Alternative.

Down wood (Current Condition)

Down wood estimates for current size and distribution were made based on reasoned estimates using inventory and stand exams from unthinned managed stands throughout the planning area. Tree mortality largely associated with self-thinning competition, cull logs from previous harvest activity, localized breakout from snow loading, and in one area wildfire has resulted in down wood levels as shown in Table 26

Smaller logs are generally in decay class I and II, while larger logs are in decay class II and III. Many of the largest pieces of down wood (cull logs from initial harvest activity) exist in decay class III. Plot data and field reconnaissance indicate existing down wood occurs in a patchy rather than even distribution across the planning area.

Table 26. Current Condition (Alternative A- No Action) and Estimated levels of Down Wood for Alternatives B an C in Comparison with DecAID

Down wood Size	Stand Type	Tons/Acre
≥6" diameter	Thinned managed stands	22.7 tons/ac
≥20" diameter		18.4 tons/acre
≥6" diameter	Unthinned managed stands	38.1 tons/acre
≥20" diameter		24.8 tons/acre

In addition to dead wood levels associated with down logs, it is estimated that decaying wood habitat associated with stumps ≥20” diameter would cover less than 1% of areas treated under either Action Alternative. The amount is considered to be equal under either of these alternatives. Use of stumps throughout a range of decay classes has been documented for a wide variety of organisms (O’Neil et al. 2001, NatureServe 2006, Rose et al. 2001, Zabel and Anthony 2003). This type of dead wood provides a valuable, long-lasting habitat component that supplements the potential to maintain native biodiversity throughout the project area.

Down wood levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). A review of DecAID data discloses current down wood levels throughout the planning area are above average values (within the 50% tolerance range) representative for dead wood in both harvested and unharvested areas within this habitat type and condition. How down wood levels in the Bridge Thin Project planning area compare to DecAID data is displayed in Table 27.

Table 27. Current Conditions (Alternative A – No Action) and Estimated Levels of Down Wood for Alternative B and C and in Comparison with DecAID

Down Wood Size	DecAID- WLCH_OCA_S	
	Unharvested inventory plots (unthinned managed stands)	All inventory plots (thinned and unthinned managed stands)
≥6” dbh	71st percentile	67th percentile
≥20” dbh	82nd percentile	78th percentile

Normal processes that influence these changes (dynamics) are highly variable in their ability to affect change (Rose et al. 2001). Natural fire interval for this area has been estimated at 50-200 years (USDA 1995). Insects and pathogens continually contribute to successional development; however, traditionally this occurs at a small scale in this area relative to the overall landscape. The area is not prone to flooding or landslides which may also affect changes on a small scale. Windthrow is yet another normal process that has occurred, and would continue to occur unpredictably, to influence stand dynamics in this area on a small scale. Because the overall condition of the project area is largely influenced by previous management activities that have simplified stand and landscape structure and diversity, additional stand management may be seen as a method to assist in restoring some landscape conditions, such as stand dynamics associated with creating more normal levels of snags and down wood. Snag creation in the 1990s through year 2006 have already contributed in this regard as an average of one snags/acre were created across approximately 12% of the project area.

A number of events throughout the watershed, as well as within the project area, have occurred to increase dead wood levels across the landscape. District fire records reveal that from 1970 to 2007, 46 small wildfires averaging less than one acre each have contributed to additional levels of dead wood in a patchy distribution throughout much of the WLCH habitat in four townships in the watershed immediately surrounding the project area. Any tree mortality associated with fires > 40 years ago is likely to currently function as down wood habitat. Mortality from fires within the past 40 years (n=46) is likely currently functioning as snag habitat. Fire intensity has ranged from mild to moderate under burning. No salvage has occurred associated with any of these events.

In addition to dead wood levels increasing related to effects from wildfire, effects from insects, disease, and other natural events have further increased this habitat component across the landscape surrounding the Bridge Thin Project area. Annual aerial insect and disease detection surveys from 1986 through 2006 have documented several sites across the watershed (including locations within the planning area) where snag habitat is increasing in a patchy distribution from effects of these mortality agents (USDA 2005).

Reference information extrapolated from DecAID suggests current size, abundance, and distribution of snags and down wood exceeds average historic levels (50% tolerance) across the project area considering habitat type and vegetation condition. It should be noted that with respect to snags or down wood, the objective of the Bridge Thin Project is more directed at managing for an average historic dead wood habitat condition rather than focusing on specific dead wood requirements for individual wildlife species.

Environmental Consequences—Snags and Down Wood

Alternative A—Direct, Indirect, and Cumulative Effects

Alternative A does not propose management activities at this time and therefore would not alter snags and down wood. Existing vegetation conditions would continue to follow natural successional pathways, with snags and down wood responding accordingly. Snag would be created as insect and disease agents as well as suppression mortality continue. Alternative A would have no direct, indirect, or cumulative effects on snag and down wood in the project area

Alternatives B and C—Direct and Indirect Effects

Some loss of existing snag habitat would occur under either Action Alternative, due to safety issues. Some existing snags in proximity to harvest activities would present a serious safety risk to workers involved with implementing the silvicultural prescription. Snag loss would be greatest among sizes <10” dbh, intermediate for snags ≥10” - <20” dbh, and lowest among snags ≥20” dbh. All felled snags would be left as down wood. Depending on decay class and burning conditions, some felled snags may be fully or partially consumed during subsequent fuels reduction and prescribed underburning in selected areas.

Under the silvicultural prescriptions for this project green trees would be harvested from specified areas by variable density thinning. Following these prescriptions would result in a minimum range of 34-72 trees per acre being retained, some of which may have defects that would provide a dead wood habitat component distributed throughout the project area. The silvicultural prescription for Riparian reserves calls for protection and retention of habitat features such as hardwoods and the largest conifers, some of which possess decadent features providing an arboreal dead wood habitat component.

Implementing the fuels treatment prescription under either Action Alternative should not affect current snag levels. On these acres, less than 10% live tree mortality estimated from under burning translates to approximately 3-7 snags/acre created in an area that involves approximately 40% of all acres thinned, and less than 1% of the planning area. However, it is also reasonable to assume some level of partial or full mortality associated with trees immediately adjacent to pile burning activity. Any such mortality would add to an existing patchy distribution of snag habitat throughout the planning area.

Within stand variability throughout the planning area influences current snag distribution. This variability would also influence the location of replacement snags, which would be provided for in a patchy rather than even distribution across the area. This prescription is common to each Action Alternative and would assure compliance with Northwest Forest Plan guidance to maintain 40% of potential populations of cavity nesting species (USDA, USDI 1994 page C-42).

Post treatment snag sizes and quantities would also be consistent within the range of average levels recently provided from plot data from unharvested stands in a Western hemlock vegetation series such as those influencing habitat throughout the project area (McCain 2006). These data are presented in terms of tolerance levels and tolerance intervals described in DecAID. They reveal that 50% of individuals in all populations of species using snags in a Douglas fir and Western hemlock series types can be expected to occur where a range of 4-7 snags per acre ≥ 20” dbh exist. Although these data apply to unharvested tree condition class stands, snag habitat throughout the Bridge Thin project area would fall within this range.

Based on current stand structure, composition, and habitat type there is generally sufficient site-specific potential to support application of the Northwest Forest Plan Standard and Guideline (ROD page C-40) to leave an average of 240 linear feet of logs per acre greater than or equal to 20 inches in diameter or material of the largest diameter class available across areas treated by the Bridge Thin Project under either Action Alternative.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area was the Bridge Thin project area. As mentioned above the project area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006) Approximately 42% of the project area is in non Forest Service ownership. Approximately 75%, or 6,400 acres, of these non Forest Service lands have been managed for timber production .

Past management actions related to timber harvest activity are generally responsible for the current condition of dead wood habitat throughout the planning area. These actions have affected the overall amount and distribution of dead wood habitat by reducing the amount of old-growth habitat and increasing the amount of mid-late seral habitat. There are no foreseeable actions that would affect dead wood habitat in this area. Current science and the changing trend in timber management that has occurred within the past decade, and projected for the future, should positively influence management of decaying wood as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands.

Data analysis reveals the amount and distribution of snag and down wood habitat would essentially remain unchanged or experience a slight increase under either Action Alternative.

Commercial thinning as proposed under either Action Alternative for the Bridge Thin Project is therefore likely to have little or no cumulative effect on dead wood habitat throughout the planning area. The action alternatives would allow trees to grow larger and faster, and to develop characteristics such as large limbs and crowns.

Dead wood habitat should exist in a sufficient amount and distribution to support the local wildlife community, including MIS such as pileated woodpecker, marten, and cavity nesters such that their ability to persist or become established would not be limited by this habitat component important to most members of the wildlife community in this area.

Alternatives B and C—Conclusions

Under either Action Alternative the Bridge Thin Project proposes commercial thinning in approximately 55% of mid-seral (stem exclusion) habitat throughout the planning area. This relates to approximately 18% of the entire planning area. Proposed openings associated with compaction areas under Alternative B are generally lacking in snags and down wood. There is essentially no difference between Action Alternatives and their effect on dead wood.

The silvicultural prescription calls for protection of existing snags and down logs. However, some amount of loss or disturbance of snags and down wood is inevitable as a result of safety and logging feasibility issues. Measures are identified to address this loss or disturbance. Effects analysis reveals that proposed activities in conjunction with mitigation measures would result in a stable or slight increase in dead wood levels associated with areas treated. Direct and indirect effects would be limited to an undeterminable number of snags and logs that may be unavoidably affected or created within harvest units.

DecAID relies on data from unharvested plots to assist managers in setting objectives aimed at mimicking natural conditions. Considering the current condition of snag and down wood habitat along with the information presented above, it is expected that dead wood levels throughout the planning area should remain above average in the natural range considered for similar habitat following thinning, prescribed fuels reduction, and underburning.

The Bridge Thin Project would result in maintenance and promotion of dead wood habitat throughout a managed forest that typifies the planning area at levels that would ensure its ongoing central role in the ecological processes affecting this type of forested habitat (Rose et al. 2001). The project would comply with S&Gs pertaining to snag and down wood management.

Management Indicator Species

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Management Indicator Species includes the project activity units and Forest Service land within the McKenzie River/Elk Creek 6th Field sub-watershed.

Affected Environment—Terrestrial Species

Management Indicator Species (MIS) were addressed in the Willamette Forest Plan. They include the spotted owl, pileated woodpecker, marten, elk, deer, cavity excavators, bald eagle, peregrine falcon, and fish. All of the management indicator species may occur in the Bridge Thin Project area.

Through Region-wide coordination, each Forest identified the minimum habitat distribution and habitat characteristics needed to satisfy the life history needs of MIS. Management recommendations to ensure their viability were incorporated into all WNF Plan Action Alternatives. Current conditions for the spotted owl and bald eagle are discussed in the Wildlife BE in Appendix C. Habitat for elk and deer is discussed in the Big Game Habitat section in this chapter.

Environmental Consequences—Terrestrial Species

Alternative A (No Action)—Direct and Indirect Effects

Under Alternative A, no change to habitat of management indicator species would occur; forest stands would continue to develop following natural successional pathways and aquatic resources would remain similar to current conditions. Alternative A would be expected to meet applicable Standards and Guidelines from the Willamette Forest Plan. Alternative A would have no direct, indirect, or cumulative effects on habitat of management indicator species in the project area

Alternatives B and C—Direct and Indirect Effects

Bridge Thin Alternatives B and C meet all applicable Standards and Guidelines from the Willamette Forest Plan. All alternatives of the Bridge Thin Project would meet Northwest Forest Plan Standards and Guidelines, and therefore maintain persistent populations of spotted owls, pileated woodpeckers, and marten (USDA Forest Service, USDI Bureau of Land Management. 1994. Appendix J2). Under Alternatives B and C, changes in the amount or characteristics of required habitat for these species would be minimal.

Impacts of alternatives of the Bridge Thin Project for the spotted owl, bald eagle, peregrine falcon, and fish can be found in the Biological Evaluations in the Appendices B and D. This project may affect, but is not likely to adversely affect, the northern spotted owl due removal of dispersal habitat in Alternatives B and C. The spotted owl is discussed further in the previous section. This project has no effects on bald eagles or peregrine falcons. Impacts of the Bridge Thin Project on elk and deer are discussed in the Big Game section.

While pileated woodpecker and marten may be displaced by harvest and burning activities in this area, populations throughout their range have not been identified as being in decline, as indicated by their absence from the Regional Forester's Sensitive Species List (USDA Forest Service. 2002).

Alternatives B and C—Cumulative Effects

The wildlife species listed as MIS for the Willamette National Forest and present in the project area, are discussed elsewhere in this EA. Cumulative effects on deer and elk are also discussed above.

The implementation of either action alternative would not result in significant, incremental effects on the remaining MIS species or their habitat within the project area (including pileated woodpeckers, pine martens and non-TES fish), when considering the effects from all past actions in the analysis area. There is no foreseeable future habitat management actions planned within the Bridge Thin Project area that would add to the cumulative effects of the past and currently proposed actions or action alternatives.

Affected Environment—Fisheries

Management indicator fish species found in this area were described previously in the Aquatic Resources discussion. The MIS fish species described are spring Chinook salmon, bull trout, rainbow trout, cutthroat trout, mountain whitefish, and brook lamprey. Because the distribution and range of these MIS fish overlap and possess similar requirements in water and habitat quality, the analysis findings for spring Chinook salmon and bull trout (main stem McKenzie River), and cutthroat trout (small tributaries) were used to evaluate effects.

Environmental Consequences—Fisheries

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Under Alternative A, no change to habitat of management indicator species would occur; forest stands would continue to develop following natural successional pathways and aquatic resources would remain similar to current conditions. Alternative A would be expected to meet applicable Standards and Guidelines from the Willamette Forest Plan. Alternative A would have no direct, indirect, or cumulative effects on habitat of management indicator species in the project area

Alternatives B and C—Direct and Indirect Effects

Project effects summarized in the Fisheries Biological Assessment (Appendix B) describes potential effects of the project to Management Indicator Species and their habitat. Project direct, indirect, and cumulative effects would not adversely affect fisheries MIS. Water and habitat quality would be maintained meeting the objectives of the Willamette National Forest LRMP and Aquatic Conservation Strategy of the Northwest Forest Plan.

Alternatives B and C—Cumulative Effects

A review of the analysis area for past action, the proposed action, and any foreseeable future actions was completed. Previous road construction and timber management has affected the condition of fish habitat in the analysis area as discussed in Water Quality/Aquatic Resources effects. The proposed action and the action alternatives would not incrementally contribute to loss of aquatic habitat (in action alternatives, primarily through proposed drainage improvements to the existing road network). Timber management activities and their proximity to waterways were designed to maintain existing water quality and minimize potential disturbance to native aquatic biota (as sources of sedimentation). Potential to increase stream temperature with the proposed action and action alternatives does not exist, due to protection of sources of shade to perennial waterways.

Following examination of the cumulative effects from past actions along with the proposed projects, the additional management-induced effects from this project would not change the following:

1. The timing or magnitude of peak flow events (planning sub-drainage ARP remain above the Willamette Forest Plan recommended levels);
2. Instability of stream banks [recommended ARP midpoints are exceeded, and exclusion of bank destabilizing activity);
3. Adverse alteration of the supply of sediment to channels (localized increases of short duration would not adversely modify project area sediment supply);
4. Adverse alteration of sediment storage and structure in channels (current channel conditions would be maintained with proposed action alternatives).

Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by TES aquatic species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through bull trout and spring Chinook salmon access to historic refuge areas.

No other foreseeable project planned in the Bridge Thin Project area would add incrementally such that the proposed activities, in combination, would adversely alter aquatic habitat conditions. This assertion includes the cumulative impacts of past actions. The quality of Critical Habitat important to listed aquatic species (spring Chinook salmon and bull trout) is expected to be maintained with implementation of the proposed action (Alternative B) or other alternatives (Alternative C). Similarly, the No Action Alternative would maintain habitat conditions currently available to ESA listed aquatic species.

Fire and Fuels

Scale of Analysis

The Bridge Thin Project area is within the McKenzie River / Elk Creek Subwatershed (6th field) of the McKenzie River/Quartz Creek Watershed (5th Field). Project models were used in the analysis that incorporated both project and landscape level data (see specialist report for details). This is related to the need to understand the role of fire as disturbance agent, and how fire moves across the landscape. To identify specific effects of fuels treatments, models focused on the proposed activity areas using field information and landscape level data.

Fire regimes and Fire Regime Condition Class (FRCC) were evaluated at the landscape level, with the most recent information from the Northwest Oregon Ecology work group with Jane Kertis, Fire Ecologist for the Siuslaw and Willamette National Forest. The Bridge Thin area is FRCC2, or moderately altered from the range of historic variability for this area.

Fuel loading (amount of fuel measured in tons per acre) was analyzed at the stand level. Fire behavior predictions were calculated using the predicted fuel loading with larger landscape level factors such as topography and weather. Detailed fuels analysis information is found in the Project Fire and Fuels Specialist Report in the analysis file.

Affected Environment—Fire Fuels

Fire History

Fire has and will likely continue to play an active and vital role in our forest ecology. Historically, fires occurred across the Willamette National Forest creating a mosaic pattern in vegetation. The variability that creates this mosaic pattern is related to differences in location and seasonality, which result in fires of varying intensity and severity. Fires were often caused by lightning, and there are references and stories of local Indigenous people historically using fire for managing resources and travel routes (Teensma 1987). Fire is a natural disturbance and the influences of human actions (development and resources) over the past century warrant management activities to aid in maintaining, providing, and reducing hazards. Teensma (1987) studied fire history in an area adjacent to the Bridge Thin, identifying the mean fire return interval (MFRI) for the area to range from <100 - 166 years.

Past management activities that have changed the fuel profile or fire behavior are grazing, timber harvesting, fuels treatments following timber harvests, and fire suppression. In 1920 management in National Forests began suppressing fires and managing for resource products which altered the natural regimes of fire. Forty-six fires occurred in the Bridge Thin project area during the period of 1970-2007. All fires were suppressed and most were contained to less than one acre, with the largest being five acres. Lightning accounted for 30% of the fires in the Project Area and the others were human-caused. Based on the recorded data from Willamette National Forest, the fire frequency is 1.24 fires per year, which implies that fire is a disturbance process in the forest ecosystem.

Grazing occurred through the Upper McKenzie Valley from the 1800's to 1948 (UMWA 1995). Grazing reduced fuels in the open meadow areas and curtailed regeneration of many conifer species. Currently many of these open areas have transitioned to encroaching conifers among the grass and oak or into conifer dominated stands. Many of the proposed Bridge Thin units have been previously managed. Earlier commercial harvest, mostly regeneration harvests, left non-merchantable large woody material and fuels were not treated. Later harvest methods included yarding merchantable material and broadcast burning. Prior to the 1970's, the scale of acres treated was much larger than the more recent practices. The number of acres harvested within the past 60 years in the Bridge Thin Project Area is approximately 3,711 acres. No natural fuels prescribed fire (prescribed fire without timber harvest) has occurred in the Bridge Thin Project Area in the past 50 years. Teensma's dissertation shows how the natural fire rotation changed from eras with Native American communities (AD 1772-1830), Anglo-settlements (AD 1851-1909), and current fire suppressors (AD 1910-current).

Fire Regimes

Fire regimes classes estimate the frequency that natural fire would occur on the landscape without human intervention (Agee 1993). At the national level, five fire regimes are used: I, II, III, IV, and V (Schmidt et al. 2002 and Hann et al. 2004). Within the Bridge Thin Project Area the following Pacific Northwest Region 6 Fire Regimes have been classified:

Fire Regimes in the Bridge Thin Project Area (See Figure 27)
• **Fire Regime I –** < 0-35 year fire return interval; low severity
• **Fire Regime IIIa –** < 50 year fire return interval; mixed severity
• **Fire Regime IIIb –** 50-100 year fire return interval; mixed severity
• **Fire Regime IIIc –** 100-200 year fire return interval; mixed severity
• **Fire Regime V –** 150+ year fire return interval; high severity

Of importance in the Fire Regimes description is the use of mixed severity. This term is used to describe the varying degrees of fire intensity that can occur over the landscape. Some factors contributing to mixed severity in Fire Regimes are: 1) the topography, 2) vegetation, 3) the ability of larger trees to withstand high-intensity fires. Variations in these factors result in different levels of tree mortality. Mixed severity fires are not stand-replacing but rather create a patchy mosaic of different mortality across the landscape (Kertis et al. 2007).

In addition to the frequency and severity, fire disturbance is categorized into Fire Regime Condition Class is (FRCC). FRCC (see Table 28) describes the degree of departure of current vegetation from the historic fire regime, and helps to establish reference and evaluate risks to the ecosystem (Hann, et.al. 2001). The Bridge Thin Project Area is categorized as a FRCC2 (See Figure 28).

Table 28. Fire Regime Condition Class (FRCC) Definitions

Condition Class	Departure of Fire Regime from Historic Range	Risk of Losing Key Ecosystem Components	Alteration of Vegetation Attributes form Historic Range
FRCC 1	Departure is not more than one return interval	Low	Functioning within the historic range
FRCC 2	Moderate change in size and intensity has resulted	Moderate	Moderately altered
FRCC 3	Dramatic changes in fire size has severity have resulted	Severe	Substantially

Fuel Profile

Fuel models describe the fuel profile in the Bridge Thin Project Area. Fuel models are a quantitative way to describe surface fuel loading (amount of fuel in tons/acre), arrangement, structure, and calculate predicted fire behavior. The primary fuel that carries fire is represented by the general classification fuel models, i.e. grass, brush, timber litter, or timber slash. Fuel loading and depth correlate to the fire intensity and rate of spread. Horizontal fuels refer to ground or surface fuels, while vertical fuels refer to the ladder fuels such as limbs on the bole of trees, crown base height (CBH), regeneration, and brush.

Fuel loading and fuel models are described below. Both are used to calculate and predict expected fire behavior. Fuel loading is measured using size of fuel that relates to time frames based on how the

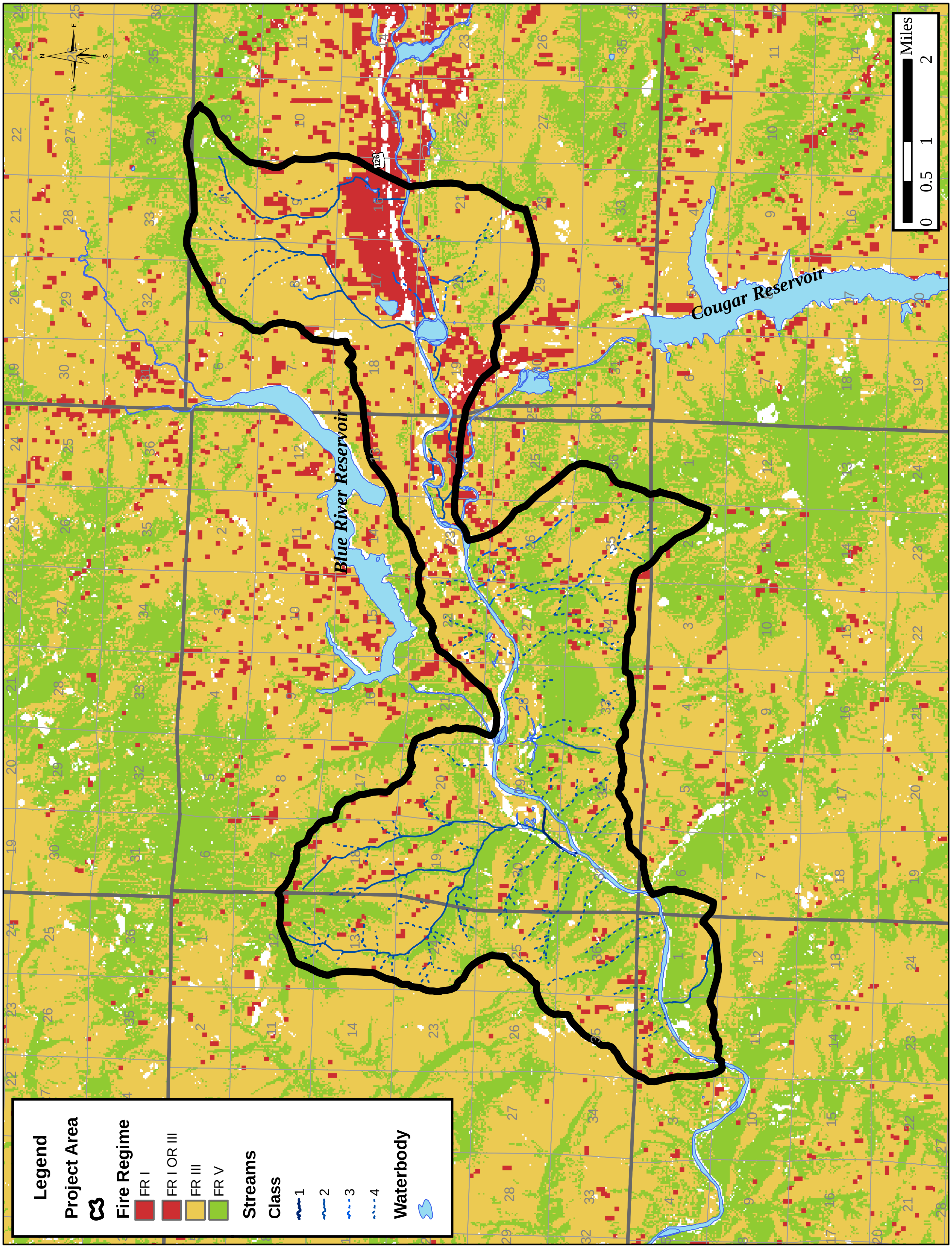


Figure 27. Fire Regime map.

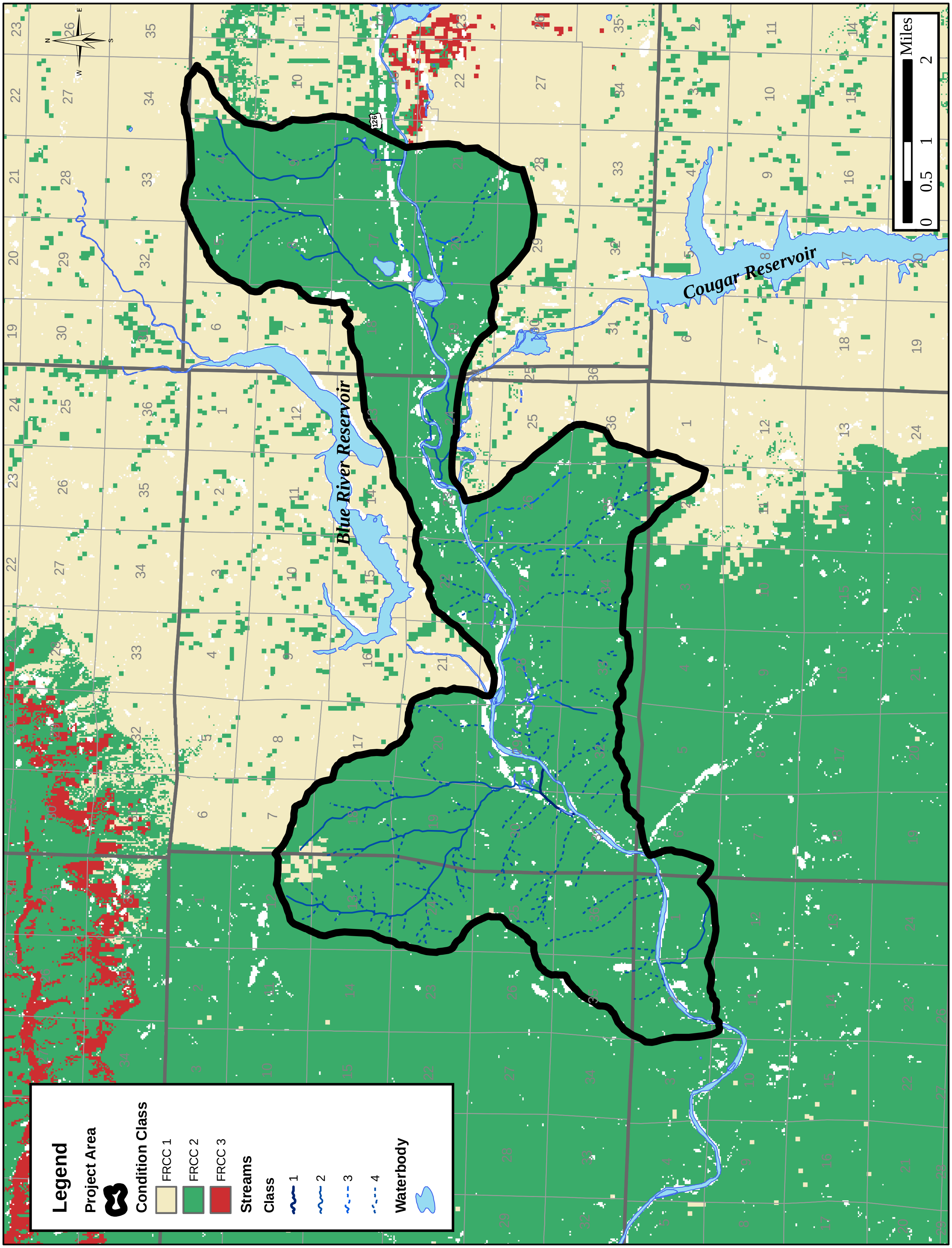


Figure 28. Fire Regime Conditon Class map.

fuel responds to moisture (how long it takes to dry and become consumable) and are then quantified using tons/acre. Measurements for fuel loading are:

- 0” – .24” diameter or 1 hour fuels
- .25” – .99” diameter or 10 hour fuels
- 1.0” – 2.99” diameter or 100 hour fuels
- ≥3.0” diameter or 1000 hour fuels

The Bridge Thin Project Area is represented by the following fuel models (FM):

Bridge Thin Project Area Fuel Models
• **FM 1**– Representative of grass meadows or openings. Fuel loading in the 0-3 inch diameter fuels is less than 1.5 tons/acre. Less than one-third of the area contains trees or shrubs. Fire spreads quickly in this fine fuel when it is cured or nearly cured. *Example – open oak savannah above Highway 126*.
• **FM 5** – Representative of timber plantations and natural regeneration between two and 10 feet tall. *Ceanothus velutinus* is the common understory brush. Shrubs or grass in the understory can carry the fire. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 3.5 tons/acre. *Example – second growth units under 30 years old that have trees ≤35’ tall and a shrub component along the 1501 or 2633 Road*.
• **FM 8** – Mature short-needle conifer stands with light fuel loading in the 0-3 inch diameter fuels. This profile can be found in stands that were or were not previously harvested. Fire spread is generally slow with low flame lengths. Heavy fuel concentrations (jackpots) can flare up. Fuel loading in the 0-3” diameter for live and dead fuel is less than 5 tons/acre. *Example – area along Langasher Road with few understory shrubs or regeneration.*
• **FM 10** – Representative of mixed conifer stands with heavy concentrations of large down wood, > 9” diameter. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 12 tons/acre. Ground fire behavior is higher in intensity than fuel models 8 because of the heavier fuel loading and the ladder fuels. Torching of trees (fire in the crowns of trees) occurs more frequently. *Example – units on the south side of King Road on the SE portion of Bridge Thin Project Area.*
Private land has FM11 and 12 (but they were not analyzed on the ground) and these would also explain fuels post harvest on National Forest land.
• **FM 11** – Light slash load resulting from light to moderate partial cuts or harvests which yard tops of trees attached to the last log. Fuel loading in the 0-3” diameter for live and dead fuel is <12 tons/acre. The continuity of the slash can increase fire behavior.
• **FM 12 –** Moderate slash loads resulting from moderate or heavy partial cuts. Fuel loading in the 0-3” diameter for live and dead fuel is < 35.6 tons/acre. Fire behavior can be rapidly spreading, especially with red needles still on the branch wood.

Table 29. Existing Condition - Fuel Model within Bridge Thin Project Area *.

	FM 1	FM 5	FM 8**	FM 10**
Acres within Bridge Thin Project Area	471	5,092	9,015	5,833

**:Data derived from2000 FSVeg.*
***:Some private lands are not identified as FM12, they are identified as FM 8 & FM10.*

The term hazardous fuel is used in current publications, such as the National Fire Plan. Current and potential hazardous fuels in the Bridge Thin Project Area are presented below.

Current and Potential Hazardous Fuels
• Fine fuels (1, 10, and portions of 100 hour) generated following timber harvest;.
• Forested areas that have been excluded from disturbance processes;
• Vegetation structure with fine fuels on the ground, shrubs and small trees in the understory, lichen on larger trees, and tight canopy closure all contributing to rapid horizontal and vertical movement of fire;
• Continuous fuel near structures that could easily cast embers on to rooftops.

Fire Behavior

The Bridge Thin Project Area has a fire frequency of 1.24 fires per year. Fire behavior was modeled using BehavePlus3 with inputs that correspond to the Bridge Thin Project Area, and summer fire weather data representing hot, dry fire weather (97th percentile) similar to summer weather experienced in 2003 and 2006. Areas with light fuel loading, such as FM 8, exhibit low intensity fires with low severity (low mortality of dominant vegetation). Fuel Model 10 exhibits high fire intensity and high severity including crown fire with mortality. Fuel Model 5 is also high fire severity and fast rates of spread. FM10 and FM5 are difficult to contain because:

- flame lengths exceed the safety of hand tooled firefighters (flame lengths over 4 feet in height require mechanized equipment, air resources, or indirect attack);
- rates of spread over 6 chains/hour (1 chain = 66 feet) and this exceeds the capability of a 20 person crew.

Larger fuels, > 9" diameter, are not often considered the carrier of fire. Large 1000 hour fuel would create longer lasting intensity, higher flame lengths and enable crown and high severity fires to progress. Standard fire suppression operations would require mechanized suppression resources when flame lengths reach heights over four feet. Firefighters are not able to safely suppress fires directly if the flame lengths exceed four feet.

Wildland Urban Interface (WUI)

The Bridge Thin Project Area surrounds private land along the McKenzie River, the Town of Blue River, the development of Rainbow, and several groups of homes and structures. These areas are considered Wildland Urban Interface (WUI) which is defined as a vicinity of 1.5 miles around structures (Silvis Lab, website). These communities are in Lane County and are part of the Lane

County Community Wildfire Protection Plan (CWPP). This CWPP was developed by communities in Lane County and the Oregon Natural Hazards Workgroup in 2005, and adopted by the Lane County Board of Commissioners. The implementation of this plan has not begun in all communities in Lane County but should be in the near future (http://www.co.lane.or.us/Planning/CWPPtoc.htm). Many of the cabins leased from the Forest Service do not have defensible space as specified in *Living with Fire* or the Firewise website (www.firewise.org). Private homes have not been evaluated by Forest Service employees, but also appear to lack defensible space.

Open Oak Savannah

Oregon white oak is located above Highway 126 on the south facing slopes. The area is identified as a unique and rare habitat in Management Area 9d and exhibits the characteristics of Fire Regime I. A series of aerial photographs dating from 1936 to 2006 illustrate the expansion of conifers into the open oak savannah. The encroachment of conifers and the loss of open oak dominated hillside may be due to the lack of fire disturbance because fire is considered the major natural disturbance in this habitat (Johnson, 2001).

Environmental Consequences—Fire Fuels

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A would not support returning fire as a natural disturbance process to the ecosystem due to fire suppression responsibilities and life, structure, and resource priorities. Through time, fuel loading would continue to increase and vegetation would continue through successional pathways. Stands would continue to grow increasing fuel loading on the ground and canopy closure thus escalating potential wildfire behavior. Areas near private residences would not have any reduction in fuels to aid in reducing wildfire intensity and mitigating hazards for firefighters. In the absence of prescribed fire and treatments, ladder fuels and canopy closure would be high, thus providing propellants for severe, high intensity wildfires. FRCC would not be maintained at a FRCC1, again reducing the natural forest resiliency to fire disturbance. Alternative A would not create the desired future condition, reduce firefighting risks, or be cost effective due to suppression of high severity fires. No foreseeable prescribed fire management activities are scheduled to occur in the Bridge Thin Project Area that could contribute to incremental cumulative effects

Alternatives B and C—Direct and Indirect Effects

Harvests increase fuel loading in a unit, which increases the wildfire behavior potential. Following the harvest a greater hazardous fuels condition exists for 0-5 years because of the lofty, red-needle slash. This slash has high ignition and spread potential, but this would be reduced with the fuels treatment 1-2 years post harvest. The lack of variability in the horizontal and vertical fuel profile across the landscape also increases the spread potential and intensity of wildfire. The proposed fire and fuels actions in Alternative B and C would change the fire and fuels environment by implementing the actions listed below.

Actions to Change Fire and Fuels Environment
• Returning the historical disturbance process of fire with prescribed fire treatments; • Reducing hazardous fuels to Forest Plan standards and guidelines levels and create variability in the horizontal and vertical profile; • Creating a mosaic and distribution of seral stages present in a mixed severity fire regime taking steps towards change from FRCC2 → FRCC1; • Incrasing fire tolerant conifers and shade tolerant conifers. • Creating safe and cost effective conditions for protection of life, structures, and resources through reducing the risk of potential high severity fires.

All prescribed fire treatments would create variability across the landscape and return a vital disturbance process to the ecosystem. The distribution of seral stages that determine the FRCC would not completely change the Bridge Thin Project Area from a FRCC2 to a FRCC1. However, the treatments would move towards reaching a FRCC1. Future treatments would need to take place in order to reach that goal and create the early, mid, and late seral stage distribution that is required under a FRCC1.

The proposed action timber harvests would create varying amounts of timber slash in each unit. The increased fine fuel loading may reduce the success of initial attack suppression operations due to the fast rate of spread and the flame lengths at >4 feet. Activity fuels (slash) treatments would reduce the amount of fuel created from the harvests to the S&G fuel loading of 7-11 tons/acre for 0-3" diameter fuel. Fuels treatments are schedule to occur within 1-2 years after the harvest. A reduction in fuel loading would reduce the potential wildfire behavior.

Table 30 displays the changes in fire behavior within the unit of treatment for existing, post harvest, and post fuels treatment conditions. Fire behavior that exceeds 4 feet flame lengths require machinery or aerial support to reduce the risks to tooled firefighters.

Table 30. Existing fire behavior

	Rate of spread (chains/hour)	Flame length (feet)	Crown fire with % mortality*	Spotting potential (miles)
FM5	117 ch/hr	13 feet	Active 99% mort	Yes at 0.6 miles
FM10	38 ch/hr	11 feet	Active 37% mort	Yes at 1.5 miles
FM12	37 ch/hr	13 feet	Active 97% mort	Yes at 0.6 miles
Post Fuels Treatment**	5 ch/hr	2 feet	Active 12% mort	Yes at 0.6 miles

**:Crown fire activity is displayed as Active, which means that fire is present in both the surface fuels and canopy fuels.*
***:Post fuels treatment examines the fire behavior as FM8 because units would have lower fuel loading, higher CBH, and varying canopy density.*

Forest Plan Standards & Guidelines to be met in fuel treatment units:
• reducing fuel loading of 7-11 tons/acre for 0-3" diameter fuel; • maintaining duff coverage of 85% or more; • weight of equipment and machinery would be with in range;

- downed woody debris minimum of 240 linear feet of 20" DBH;
- IDT decision to keep mortality at 10% or less.

Underburns in Units 84, 85, 86, and 87 aim to restore the unique and rare habitat of the open oak savanna. The open oak savanna would benefit from being burned every 5-15 years to reach and maintain the goal of reducing conifer encroachment and maintaining oak as the dominant species (Regan and Agee 1996). With the lack of disturbance, the faster growing conifers would overtake the oak in theses areas. Returning fire disturbance and reducing competition from conifers would support the restoration and subsequent maintenance of this unique habitat.

Fuels thins would occur in Units 50, 95-99,101-103; and all of these units are in WUI. Potential wildfire behavior would be reduced, due to a decrease in surface fuel loading, an increase in crown base height through the reduction of ladder fuels, and an increase in vegetation variability continuity post treatment. Chipping/mulching would not remove the fuel from the site, but it would change the fuel loading to a more compact profile, condensing the lofty fuels where rates of spread would be less. These changes create part of the defensible space next to the private land and along the highway where human caused fire, such as a burning cigarette thrown from a car, can ignite wildfires. Following the treatments the fuel profile would aid in protecting the private property if a wildfire were to approach the area and reduce the risks to firefighters.

The proposed treatment of Unit 100 would be a natural fuels underburn. This unit is also along King Road next to private land. A natural fuels underburn would reduce hazardous fuels, decrease the movement of wildfire from the ground to the canopy by reducing the ladder fuels, and creating variability in the canopy cover. Mortality in these stands would be approximately 20% or less. Underburning would change the fire behavior from FM10 to FM8 in wildfire conditions. Underburning is a preferred method of treatment not only to reduce hazardous fuels but to return fire to the ecosystem. However, a fuel thin may be the first treatment in these areas, due to the close proximity of houses.

Treatments in units located near private residences aim to protect and increase the defensible space in the WUI. The proposed treatments would occur on 142 acres and reduce the spread of a wildfire near the homes through the reduction of ground and ladder fuels. This decreases the potential for ground fire to carry into the canopies and produce embers that can land on roofs, which is one of the main ignition sources in the WUI. Life, private property/structures, and resources are the highest priority to protect during wildfire suppression.

Direct and Indirect Effects Unique to Alternative B

Units 80, 81, 82, 83, 88, and 91 are proposed to be underburned post harvest. These units are located above Highway 126 and are within WUI. The fuels and variability in the horizontal and vertical profiles would change, thus reducing the potential severity of wildfire behavior. Being in the WUI this would also reduce the risks and hazards during fire suppression.

Alternatives B and C—Cumulative Effects

Cumulative effects are based on management activities that have or would occur in the Bridge Thin Project Area. The area analyzed display the direct and indirect effects of fire on the treated units, which translates to the variation of fuel profiles over the larger area. No other hazard reduction projects have been identified in the Lane County CWPP within the Bridge Thin planning area. Oregon Department of Forestry defensible space surveys of homes within the WUI area are currently underway and may identify projects on private property suitable for hazard reduction grants. No foreseeable future fuels management activities that would contribute incrementally to the cumulative effects from past or currently proposed activities are planned within the Bridge Thin Project Area.

Proposed fuel treatments, in concert with harvest activities, would help to diversify the fuel profile across the landscape. This would aid in decreasing the severity of a wildfire within treated stands in the Project Area. No adverse effects on the fuel profile or on fire behavior would result from the proposed fuel treatments.

Alternatives B and C—Conclusion

Alternatives B and C fuels treatments would be conducted following Forest Plan S&Gs. Hazardous fuels would be reduced to meet the desired future conditions, and the current FRCC 2 would be moved closer to FRCC 1. WUI units would aid in creating safer conditions for firefighters and home owners, and all the treatments would reintroduce the disturbance process of fire to the ecosystem.

Air Quality

Scale of Analysis

The area defined for direct, indirect, and cumulative effects analysis is the treatment units in the Bridge Thin Project area, as well as, the larger landscape where smoke emissions can travel. These are the location of the Design Areas and the Class I Airsheds.

Affected Environment—Air Quality

The State of Oregon has been delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To regulate these standards, the state developed the Oregon Smoke Management Plan and the State Implementation Plan. These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission control in Oregon (LRMP, 1990).

Designated Areas and Class I Airsheds are priority areas regulated in order to protect air quality. The Willamette Valley (at the eastern side, Leaburg) and Oakridge are the closest Designated Areas to Bridge Thin Project Area (15 and 35 miles respectively). Three Sisters Wilderness and Mt. Washington Wilderness are the closest Class I Airsheds to the Bridge Thin Project Area (3 and 11 miles respectively). Class I Airsheds must be protected from visibility impairment July 1 through September 15. Management activities on the MRRD have maintained air quality within these guidelines for the last 20 years.

Environmental Consequences—Air Quality

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

If no management actions take place in the Bridge Thin Project Area, no air quality impacts would occur in a scheduled timeframe. However, the risk of wildfire would still exist. In the event of a wildfire, air quality impacts are considerably higher than prescribed fire. Smoke emissions are not short term and can often last for many weeks or months, as witnessed during the Puzzle and GW Fires in 2006. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of Particulate Matter PM 2.5 and PM 10. Table 30 displays emissions are considerably higher than prescribed fire emissions, posing risk to community residents, forest users, and firefighters. Acreage used for the above wildfire calculation was 2,463 acres, the number of harvest and treated acres in Alternative B. No foreseeable prescribed fire management activities are scheduled to occur in the Bridge Thin Project Area that could contribute to incremental cumulative effects.

Alternatives B and C—Direct and Indirect Effects

Prescribed fire of activity fuels in the Bridge Thin Project Area would comply with Oregon Smoke Management Plan regulations. Smoke emissions can be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. Regulations enforce specific days which are suitable to burn in relation to other land owners burning or weather forecasts. Prescribed fire would most likely be avoided between July 1 and September 15 in order to protect visibility standards for Class I Airsheds.

Recreationists and residents near the Bridge Thin Project Area may be temporarily impacted by smoke from prescribed fire underburns or pile burning. In the Oregon Smoke Management Plan, non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon SMP 1995). Mitigation measures, such as signing along the road or near the treatment area, would be taken in order to reduce the amount of nuisance smoke and notifications to the public would be made prior to burning.

Smoke emissions were predicted using the estimates from the debris prediction tables and FOFEM (First Order Fire Effects Model version 5.0). This model calculates particulate matter emitted based on the amount of fuel consumed. Fuel inputs were from the predicted post harvest data and based on a percentage of fuels that would most likely be consumed given the prescribed fire window. That is, weather and fuels dryness would be measured to achieve the objective of reducing the fuel profile across the unit. From past experience, fuels treatments consume an average of 80% of the fine fuels (0-1 inch diameter), 60% of the 1-3 inch fuels and only about 20% of the 3-9 inch. LWD >9 inches is most often too wet to be consumed. FOFEM however consumes 100% of 1, 10, and 100 hour fuels in spring-like conditions. Table 31 summarizes particulate matter predicted for fuels treatment activities.

It is important to note these emissions levels do not occur at one time. Usually prescribed fire operations occur one unit at a time (in one day). For example, Unit 80 is predicted to have 24.3 tons/acre of 0-3” diameter fuel post-harvest. During the prescribed fire underburn, emissions are estimated at 2.37 tons/unit of PM 10 and 2 tons/unit of PM2.5.

Table 31. Summary of particulate matter emissions for Bridge Thin Project Area for all treatments

	Alternative A – Wildfire	Alternative B	Alternative C
PM 2.5 total	1735 tons/acre	517 tons	484 Tons
PM 10 total	2048 tons/acre	610 tons	572 Tons

Alternatives B and C—Cumulative Effects

No adverse effects on the air quality would result from the proposed fuel treatments. Smoke emissions would be short duration and mitigation measures would reduce the quantity of emissions during prescribed burns. Past management activities do not cumulatively add to air quality impacts from the proposed treatments. Proposed maintenance burns of Unit 80 should produce less smoke emission than before due to the quick prescribed fire return interval. No other foreseeable management activities are scheduled to occur in the Bridge Thin Project Area.

Invasive Plants

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Invasive Plants includes the project activity units, associated and adjacent roads, and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Invasive Plants

The Willamette National Forest categorizes invasive plants into three groups, and control strategies will differ depending on species' classification.

Invasive Plant Groups
• **Potential invaders** are those species located in adjacent National Forest or other lands that have a high probability of being detected on the Forest in the foreseeable future (next 15 years) because potential habitat exists here.
• **New invaders** are those weed species just entering the National Forest and whose populations are possible to eradicate.
• **Established infestations** include weed species that are so widespread on the Forest they are not likely to eradicate. Some species, such as blackberry, can have both new invader populations that are less than 10 plants and are outliers as well as established infestations such as those that are found bordering streams at lower elevations.

Nine new invader species exist in the Bridge Thin project area. Some of these species are shade-tolerant and more difficult to control than others are. However, all of them are capable of adverse impacts by easily populating disturbed areas and establishing monocultures by out-competing the native vegetation. The new invader species known to occur in the Bridge Thin project area are listed below in Table 32.

With the exception of false brome and English ivy, most invasive plants found in the project area are shade-intolerant and generally confined to roadsides and open areas. One of many ecological advantages of invasive or non-native plants is the lack of native competition to keep populations balanced. More so, prolific propagation and the ability to disperse large amounts of seed is probably the greatest advantage invasive plants have in native ecosystems.

Even without past or present management actions, invasive plants would still be present from natural and biological vectors. Invasive plants are present on the properties of adjacent landowners and along the Highway 126 corridor. However, past harvest and road maintenance activities within the Bridge Thin project area have provided additional opportunities for establishment and spread of invasive plants. Some management actions, such as harvest and yarding, result in short-term disturbance conducive for invasive plant establishment. The effects of these actions are greatest at the onset of implementation and often decrease over time and with stand succession.

Other management activities like road construction or maintenance often result in longer-term effects to invasive plant infestations. This is because roads serve dual functions by acting as suitable ground for the establishment of invasive plants and by providing the plants access to a host of potential vectors. The close proximity of the Bonneville Power Administration (BPA) transmission line corridor to proposed haul routes also serves as a vector of invasive plants in the Bridge Thin project area.

Table 32. Invasive Plants in the Bridge Thin Project Area

Invasive Species	Proposed Units	*Recommended treatments (in addition to Ch. 2 mitigation measures, design criteria, and BMPs)
False brome (*Brachypodium sylvaticum*)	2, 3, 19, 26, 29-32, 42, 43, 91, 95	Mechanical Chemical
Spotted knapweed (*Centaurea maculosa*)	6, 9, 19, 22, 32, 71	Mechanical Chemical
Field Bindweed (*Convolvulus arvensis*)	43	Mechanical Chemical
Yellow toadflax (*Linaria vulgaris*)	40	Manual/Mechanical/Chemical
Deadly nightshade (*Solanum dulcamara*)	26, 95,	Mechanical Chemical
Everlasting peavine (*Lathyrus latifolius*)	27, 91, 102	Mechanical Chemical

Invasive Species	Proposed Units	*Recommended treatments (in addition to Ch. 2 mitigation measures, design criteria, and BMPs)
English ivy (*Hedra helix*)	3	Manual/Mechanical/Chemical
Deptford pink (*Dianthus armeria.*)	6, 68, 103	Mechanical Chemical
**Evergreen blackberry (*Rubus laciniatus)*	82, 83	Manual/Mechanical/Chemical

*: **Manual**=hand pulling/digging before seed production
Mechanical=mowing/cutting just after flowering has ended, *but* before seed matures
Chemical=use of one or more herbicides approved for application in the Willamette National Forest Integrated Weed Management EA (March 2007)
:Established species, but considered new invader population**

Environmental Consequences—Invasive Plants

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Selecting this alternative would allow the same level of invasive plant control as currently programmed. New and potential invader plant populations documented in the Bridge Thin project area would remain highest priority in receiving treatment and monitoring.

The No Action Alternative would not provide an opportunity to further contain or control invasive plant populations, or reduce the current rate of spread of these species within the project area. This alternative does nothing to manage established new invader populations along forest road 1900-408. Further, the No Action Alternative may ultimately reduce the ability to contain or eradicate invasive plants in this area in the future because the new invader populations are capable of exponential growth and can produce seed that is viable for decades.

Alternatives B and C—Direct and Indirect Effects

Alternatives B and C propose similar acres of harvest and fuel treatments, as well as miles of road maintenance (See Tables 2 and 5). These proposed activities would produce ground disturbance and provide suitable conditions for invasive plants to establish or out-compete native vegetation.

Most of the invasive plant populations in the Bridge Thin project area are established along roads and are mainly spread by vehicular traffic. Alternatives B and C propose similar amounts of road maintenance activities and identical amounts of temporary road construction. It is also noted that false brome and English ivy occur in units proposed for harvest, ground-based yarding, and underburning fuels treatments. The risk of spreading invasive plants in the project area through harvest is highest in ground-based yarding units. Alternative B (770 acres) and C (760 acres) propose almost identical amounts of ground based harvest treatments. Skyline-based yarding poses a lesser risk, mainly centered around landings and access roads, which could serve as vectors of invasive plant introduction to units. Alternative B (960 acres) proposes 130 more acres of skyline-based yarding that Alternative

C (830 acres). Helicopter-based yarding units pose little risk of spreading invasive plants. Alternatives B (520 acres) and C (500 acres) propose similar amounts of helicopter-based yarding.

Mitigation measures (See Chapter 2) would remove or significantly reduce the risk of further spreading or introducing invasive plants or spreading invasive plants onto adjacent properties by hauling across ownership boundaries.

Any action alternative selected would have a high risk of increasing invasive plants populations in the Bridge Thin project area. Mitigation measures (see Chapter 2) would remove or significantly reduce the risk of further spreading or introducing invasive plants onto adjacent properties. However, the risk of increasing invasive plant populations is greater with either of the action alternatives regardless of mitigation measures, design criteria, or best management practices. This determination is based on the extent of the existing infestations and the ability of the invasive species present in the project area to outcompete native vegetation

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for Invasive Plants is the entire Bridge Thin project area, associated and adjacent roads. This analysis area was selected for its known distribution of invasive plants and because it contains likely travel routes for the proposed project.

Past management activities in the last 50 years include road construction, road maintenance, and timber harvest on public and private land in the project area. Included in these activities are the Bonneville Power Administration power line corridor and vegetation management activities. Because of the design criteria and mitigation measures proposed to contain and eliminate the spread of invasive plants, there would be no anticipated incremental cumulative effects on invasive plants from road maintenance or harvest activities. The potential integrated management opportunities afforded by this project would also provide additional resources to treat the new invader species in the Bridge Thin project area, and assist in reaching the goal of control and eventual eradication of new invader plants.

Roads and Access

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Roads and Access

The project area includes approximately 12 miles of State Highway 126, 6.3 miles of County roads, 12.7 miles of Bureau of Land Management roads, 22.7 miles of private roads and driveways, and 61.5 miles of Forest roads for a total of 115.2 miles within the McKenzie River Ranger District.

Past management activities in and near the Bridge Thin Project area have provided the current network of Forest Roads, mainly from timber sales. The current system of roads provides sustainable access to the area for administration, protection, public recreation, and forest product utilization, consistent with the Willamette Forest Plan. This section incorporates by reference the Willamette National Forest Road Analysis Report (USDA Forest Service. 2003), which provides detailed information regarding the Forest roads, describing maintenance levels, maintenance costs, and management direction.

Existing Condition of the Road System

Forest road 1500, known as the Blue River Road, and Forest road 1900, known as Aufderheidi Drive, are double-lane paved surfaced roads that provide the primary access to the project area from State Highway 126. Other important Key Forest roads that provide access to the area include Forest roads 1501, known as the Lower Lookout Road, and 1500-105, which are both tributary to Forest road 1500, and Forest roads 2611, known as the Mt. Hagan Road, 2618, known as Quartz Creek Road, and 2633, known as Mill Creek Road, which are all tributary to State Highway 126. There are several local Key Roads that provide access to important facilities within the project area. These Key Roads and numerous secondary roads are predominately surfaced with crushed rock.

Approximately 20.7 miles of the Forest roads in the project area are currently closed with gates, berms or other structures, or by vegetation.

The current road system allows the Forest Service administrative access to conduct a wide variety of forest management and fire protection activities in the area. Access is also provided for inspection and maintenance of the Bonneville Power Administration and Eugene Water and Electric Board hydropower and powerline facilities. Specifically, the Forest roads provide access to Forest Service administrative facilities at Blue River, the BPA's Cougar Reservoir Hydroelectric facilities, a cellular communications and mobile radio repeater site at Mt. Hagan, public recreation opportunities at Blue River and Cougar reservoirs, Delta campground, and the King Castle Trail. Numerous dispersed campsites are accessible by roads in the project area. In addition, current roads provide the means to transport timber products from the National Forest. These roads also allow public use of firewood and special forest products.

The road system receives annual maintenance in accordance with established road management objectives. However, over the last decade, a limitation on road maintenance funds on the Forest has resulted in a backlog of maintenance work to reduce brush, clean out drainages, and repair road surfaces on many of the Key and secondary roads in the project area.

Environmental Consequences—Roads and Access

Alternative A (No Action)—Direct,Indirect, and Cumulative Effects

Alternative A would not change the use pattern of roads, or correct existing road erosion problems. Without timber harvest related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance, which could eventually result in unsafe traveling conditions for public and administrative traffic, as well increasing the possibility of resource damage. There is currently a backlog of road maintenance and some local roads are becoming impassible due to fallen trees or the growth of brush. Culverts that are not maintained because of impassible roads could plug and cause washouts. Current rates of the spread of invasive plants could continue on roads not maintained.

Alternatives B and C—Direct and Indirect Effects

Road maintenance as identified in Chapter 2 would occur under all action alternatives, and would protect the road infrastructure, improve safety of the road, improve drainage, and reduce the spread of Invasive Plants. Action alternatives may cause a temporary increase in sedimentation while the work is being done, but in the long term, would decrease the volume and velocity of water that carries sediments into creeks. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts could increase sediment production until road surfaces stabilize.

Maintenance activities could cause some short-term delays or detours for road users while roadwork is being performed. Road reconstruction or maintenance would protect the existing road infrastructure, improve safety of the road, decrease sedimentation, and reduce the spread of Invasive Plants. Brushing roads increases sight distance to increase visibility for safe driving. Blading, ditch maintenance, culvert replacement, surface rocking, and installing dips or waterbars corrects or improves water drainage. Removing ditch slough, or accumulated soil, to predetermined disposal locations would reduce the likelihood of spreading Invasive Plants. Designated water sources for filling water tankers for compaction and dust abatement operations are not expected to affect stream flows.

After the road closures and decommissioning, the open road density within the project area would be reduced from approximately 42.8 miles to 42.6 miles in all action alternatives (B and C). Proposed road closures with gates or earth berms would decrease access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, and reduce road maintenance costs. Roads closed by the project would be left in a condition to drain properly and protect water quality.

There would be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access roads for fires suppression would take additional time and equipment. It would cost more to treat weeds if vehicle access is prevented (walking in to the treatment areas would be required). Future access on closed roads would have the additional cost of reopening and later re-closing the road. However, the cost of maintaining a road that has been effectively blocked to traffic and has self-maintaining water drainages is less costly than keeping it open.

Alternatives B and C—Cumulative Effects

The effect of past management actions have created a 61.5 mile Forest Service road system within the Bridge Thin Project area that requires consistent road maintenance levels to provide adequate resource protection. Alternatives B and C would provide this necessary road maintenance on the haul routes. An additional 41.7 miles of non-Forest Service roads also exists in the project area of which private roads (22.7 miles) are the majority. The incremental cumulative effect of all action alternatives would be to reduce the miles of road available within the project area for public access by approximately 0.2

miles. There are no additional foreseeable future Forest Service management actions that would add to or subtract mileage from the current roaded condition of the project area.

Recreation

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Recreation resources includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Recreation

The project area is popular for both dispersed and developed recreational activities including: scenic viewing, driving, hiking, boating, fishing, and camping in the summer. Portions of the West Cascades National Scenic Byway and the McKenzie River Corridor are within the project area.

The forested slopes along the McKenzie River form an important scenic backdrop to the National Scenic Byway that includes the portion of State Highway 126 adjacent to the project area. The McKenzie River and its adjacent lands are a favorite location for fishing, hunting, hiking, biking, photography, picnicking, and boating.

The King Castle Trail and Delta Old Growth Trail are located along the southeast portion of the project area.

Developed recreation sites within or adjacent to the project area include: Delta Campground, McKenzie Campground, Bruckart Bridge Boat Launch, Forest Glenn Landing Boat Launch and Saddle Dam Boat Launch along Blue River Reservoir.

The project area outside the designated river corridor receives light to seasonally heavy recreation use. Recreational activities include hiking, horseback riding, berry picking, viewing scenery, dispersed camping, and hunting. Hunting is particularly heavy for deer and elk in the fall. In the summer, Blue River Reservoir is popular for fishing, swimming, and boating.

Recreation residences (summer homes) in tracts Delta A and B are located within or adjacent to the project area. These residences are located on National forest land and are under a special use permit.

Recreation Opportunity Spectrum (ROS)

The Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreational Opportunity Spectrum (ROS) from the Willamette Forest Plan FEIS, page III-93. This system seeks to identify recreation settings of varying characteristics that range from small, remote, undeveloped areas to large, easily accessed highly developed sites. Settings are described in the following five ROS Classes: Primitive, Semiprimitive Non-motorized, Semiprimitive Motorized, Roaded Natural, and Roaded Modified. Whereas Primitive falls on the most unmodified natural environment end of the spectrum and Roaded Modified falls on the most substantially modified end of the spectrum. Table 33 displays the ROS for those Management Areas within the project area.

Table 33. Recreation Opportunity Spectrum for the Project Area

Willamette Forest Plan Management Areas	ROS Class	Unit(s)
5a – Special Interest Areas	ROS – Roaded Natural	95, 97, 98, 100, 102, and 103.
9d – Wildlife Habitat, Special Areas	ROS – Roaded Natural	1, 3, 6, 7, 8, 10, 21, 84, 85, 86, 88, 841
11a – Scenic – Modification Middleground	ROS – Roaded Modified	26,29, 30,32, 35, 41,42, 43, 44, 45, 46, 47, 48, 52, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.
11c – Scenic – Partial Retention Middleground	ROS – Roaded Natural	1, 2, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 27, 28, 35, 36, 37, 38, 39, 40, 41, 44, 49, 50, 51, 54, 55, 56, 58, 59,67, 68,69, 70, 71, 72, 80, 81, 82, 83, 84, 89, 91.
11e – Scenic – Retention Middleground	ROS – Roaded Natural	29, 30, 31, 32, 33, 34, 35,36, 37, 56, 57, 58, 59, 60, 69
11f – Scenic – Retention Foreground	ROS – Roaded Natural	27, 28, 80, 81, 82, 83, 84, 87, 88, 89, 91, 95, 96, 97,98, 99, 100, 101, 102, 103

Recreational Driving

The most noticeable driving for pleasure (sightseeing) occurs along the West Cascades National Scenic Byway that includes the portion of State Highways 126 and Forest Road 19, adjacent to the project area, but some use occurs along Forest roads too.

Approximately 3 miles of State Highway 126 is adjacent to the planning area. It receives heavy traffic from motorcycles, RV's, logging trucks, passenger cars and pickups, as well as bicycles. Fewer vehicles travel the Forest roads off of Highway 126 with the later traffic use decreasing in the winter months due to the snow levels.

The use of Forest road system varies from very light use on most dead end roads, to moderate use on secondary and connector and heavy use along Forest Road 19 to Cougar Reservoir. Secondary and connector roads receive increased use during the hunting and winter snow play season. These roads were primarily constructed and maintained for future timber harvest and other land management activities.

Dispersed Camping

A moderate number of dispersed campsites are located within the project area. The number and location of sites may vary somewhat as road closures limit access to some areas, and as new roads open others. The more popular sites are often found on open roads and landings. The dispersed sites are usually associated with favorite hunting areas and get-away-spots, and are often near water. Some dispersed sites are located along Blue River Reservoir and Cougar Reservoir.

Day Use

Blue River Reservoir and Saddle Dam Boat Launch are popular summer day use areas in the project area. Overnight camping is not allowed in the boat launch area at Blue River Reservoir, however, dispersed camping and access to the reservoir is from this area

Developed Sites

Delta Campground is the only developed camping site within the project area, however, McKenzie Campground is located just east of the project area boundary.

Trails

King Castle Trail and Delta Nature Trail are the only active system trails within the project area. King Castle trail crosses the southwest portion of Unit 100. Delta Nature Trail is south of Unit 841.

Environmental Consequences—Recreation

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Recreation use of the National Forest in the project area would remain unchanged with the no action alternative. The recreating public would continue to use the project area for recreational purposes, and would continue current use of dispersed sites, day use areas, developed sites, trails, and roads. Alternative A does not manage forested stands within recreation areas and there are no ongoing or reasonably foreseeable projects in the area. Therefore, Alternative A would have no direct, indirect, or cumulative effects on recreation within the project area

Alternatives B and C—Direct and Indirect Effects

Short terms effects of proposed timber harvesting, log truck hauling, and fuel treatments would be localized road closures; disruption to hunting, hiking, camping, and driving in some areas. The logging activity, hauling, and fuel treatments could cause noise and dust or smoke disturbance. The duration of these effects would only last for the duration of implementing the stand treatment. It is unlikely that all recreation use in the area would be affected at the same time.

The effects of summer timber harvest and associated activities south of Blue River Reservoir area could increase pressure on other water-related areas.

Alternatives B and C—Cumulative Effects

Past activities in the Bridge Thin Project area included timber harvest and road construction, creating a network of roads. These activities have opened vehicle access to Forest lands where dispersed recreation activities may occur.

The incremental effects of the proposed and all action alternatives would be to reduce approximately 0.5 miles of road, as discussed in Chapter 3, Roads and Access, to vehicle access open to public where dispersed recreational activities may occur.

There is no foreseeable future management action planned, which would add cumulative effects to the recreation uses condition in the project area.

Scenic Quality

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Scenic Quality includes the project activity units within Forest Plan Management Allocations MA-11a, MA-11c, MA-11e, MA-11f in the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Scenic Quality

The landscape within and adjacent to the project area is generally characterized as being a Douglas fir dominate forest. From the road, river, and reservoir corridors views are made up of an even-aged or uniform appearing over story of Douglas fir trees, hemlock and hardwood understory tree species, and common shrubs such as rhododendron, vine maple, and Oregon grape. Past and present natural and human caused disturbances/modifications (including: fire, disease, timber harvest, fire suppression, and road and facility development) are visible within and adjacent to the project area.

There are openings in the project area from past timber management activity (within last 60 years) in the visually sensitive landscape (MA-11a, MA-11c, MA-11e or MA-11f). Some older existing openings are visible in the scenic viewshed (MA-11a and MA-11c) but these stands are considered vegetatively recovered, as defined by Willamette Forest Plan standards and guidelines. Some management created openings above the river are visible from State Highway 126.

Visual Quality Objectives (VQO)

The Forest Plan establishes Visual Quality Objective (VQO) categories to describe degrees of acceptable alteration of the natural landscape when considering timber stand management (Forest Plan FEIS, page III-112). Objectives range from allowing ecological change only to allowing for human activity to dominate the characteristic landscape. The five VQO categories are: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. Following is a description of each category:

Visual Quality Objectives
Preservation: Provides for ecological change only.
Retention: In general, human activities are not evident to the casual forest visitor.
Partial Retention: In general, human activities may be evident but must remain subordinate to the characteristic landscape.
Modification: Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as natural occurrence when viewed in foreground or middleground.
Maximum Modification: Human activity may dominate the characteristic landscape but should not appear as a natural occurrence when viewed as background.

Table 34. Visual Quality Objective Categories for the Project Area.

Willamette Forest Plan Management Areas	VQO category	Unit
5a - Special Interest Areas	VQO – Retention	95, 97, 98, 100, 102, and 103.
9d – Wildlife Habitat, Special Areas	VQO – Retention	1, 3, 6, 7, 8, 10, 21, 84, 85, 86, 88, 841
11a – Scenic – Modification Middleground	VQO - Modification	26,29, 30,32, 35, 41,42, 43, 44, 45, 46, 47, 48, 52, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.
11c – Scenic – Partial Retention Middleground	VQO – Partial Retention	1, 2, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 27, 28, 35, 36, 37, 38, 39, 40, 41, 44, 49, 50, 51, 54, 55, 56, 58, 59,67, 68,69, 70, 71, 72, 80, 81, 82, 83, 84, 89, 91.
11e – Scenic – Retention Middleground	VQO - Retention	29, 30, 31, 32, 33, 34, 35,36, 37, 56, 57, 58, 59, 60, 69
11f – Scenic – Retention Foreground	VQO – Retention	27, 28, 80, 81, 82, 83, 84, 87, 88, 89, 91, 95, 96, 97,98, 99, 100, 101, 102, 103

West Cascades National Scenic Byway

In 2000, the West Cascades Oregon Scenic Byway was federally designated as a National Scenic Byway by the Federal Highway Administration and extends approximately 220 miles from Estacada to Westfir, Oregon. The West Cascades National Scenic Byway traverses the western edge of the Cascade Mountains and a segment of the route includes Highway 126 from its junction with Highway 20 south to Forest Road 19.

Approximately 3 miles of the byway near McKenzie Bridge is located within the project area. The 3 miles totals approximately 1% of the entire length of the byway. Units 96, 97, 98, and 99 are adjacent to the highway and are in Management Area 11f – Scenic Retention Foreground.

Environmental Consequences—Scenic Quality

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Scenic quality along the West Cascades National Scenic Byway would remain unchanged. The No Action Alternative would not harvest timber stands in any visual management areas in the Bridge Thin planning area, and there are no ongoing or reasonably foreseeable projects in the area. All visually sensitive Management Areas remain consistent with Forest Plan standards and guidelines, and VQOs are met. Alternative A would have no direct, indirect, or cumulative effects on scenic quality in the project area

Alternatives B and C—Direct and Indirect Effects

Short term effects to visual quality for the Bridge Thin Project area would be limited to exposed stumps from harvested trees, less dense forested stands (increasing depth of view), slash or underburned areas, and possibly dust from transporting forest products from the forest on unpaved Forest roads. Long term effects would include fewer exposed stumps due to vegetation recovery (3-6 years and after), and larger diameters and larger crowns of residual trees due to increased growing space. Intermediate harvest treatments, including fuels treatment, are expected to accelerate stand development toward a more natural range of conditions and scenic diversity in the project area. More visually interesting structure, depth of view, and mix of vegetative species are likely long term effects of proposed vegetation entry.

Units within the 11F management area would not require flush cut stumps. Units with commercial harvest that are located in 11F are on steep slopes above Highway 126 and should be no more or less visible from flush cutting. Flush cutting stumps on the slopes will also create material that could pose a hazard during harvest operations on steep slopes. Units 95-103 will not have commercial harvest and stumps will be cut low to the ground in an effort to remove small material to minimize residual fuels.

Alternatives B and C—Cumulative Effects

Considering that Alternatives B and C would include thinning of a small portion (less than 1%) in each of the MA-11a, MA 11-c, MA11-e, and MA11f visual management areas for the Western

Cascades National Scenic Byway, there would be no adverse effect on the scenic quality. Short term acceptable effects from the thinning are recognized.

The proposed action and Alternative C would not contribute additional adverse effects to the other visually sensitive areas located along Highway 126. These modifications would still maintain modest scenic quality as required in the Forest Plan, and may result in visually interesting stand structure, depth of views, and mix of trees and understory species.

Therefore, no long-term adverse incremental cumulative effects to scenic quality are anticipated considering the direct and indirect effects from the proposed action and the action alternatives. Also, no reasonably foreseeable future management actions are planned for the project area which would result in additional cumulative effects to the scenic quality.

Roadless and Unroaded Areas

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roadless and Unroaded areas includes the project activity units and Forest Service lands in the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Roadless and Unroaded Areas

The Bridge Thin Project Area includes approximately 2,600 acres of the Mount Hagen Inventoried Roadless Area (IRA). However, no project activities are proposed within the Mount Hagen IRA. The closest activity unit is located approximately 1.5 miles from the IRA, and the nearest activity unit containing unroaded areas is approximately 2.5 miles from the Mount Hagen IRA. The project area also contains about 4,287 acres of contiguous unroaded areas 1,000 acres or more in size as analyzed in the Willamette Pilot Roads Analysis, 2003 (USDA Forest Service. 2003). These unroaded areas do not exist in large blocks due to extensive road building in this area over the past 50 years, which resulted in 61.5 miles of Forest Service system roads in the project area. Existing roads provide access to a majority of proposed harvest units. None of the harvest units have portions that are greater than 1/2 mile from an existing road or a previously harvested stand.

Timber harvest would only affect Adaptive Management Areas from the amended Willamette Forest Plan. Harvest units within unroaded areas are the same for both action alternatives. Table 35 displays harvest units and approximate acres within unroaded areas greater than 1,000 acres.

Table 35. Units within Unroaded Areas*.

Harvest Unit #	Acres within Unroaded Areas
13	21
14	27
15	74
17	24

Harvest Unit #	Acres within Unroaded Areas
18	27
20	13
56	15
57	15

***** All units are within Adaptive Management Areas.

Environmental Consequences—Roadless and Unroaded Areas

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A would not implement any management actions within the project area. Natural processes and forest successional pathways would continue. Alternative A does not manage forested stands within unroaded areas and there are no ongoing or reasonably foreseeable projects in the area. Therefore, Alternative A would have no direct, indirect, or cumulative effects on unroaded areas or on any roadless values that currently exist within the project area.

Alternatives B and C—Direct and Indirect Effects

Soil, Water, and Air

The effects of the action alternatives on water quality, soils, and air are discussed elsewhere in this chapter (Aquatic/Riparian Habitat and Soils). Stands within the unroaded areas managed with thinning or group select harvest treatments would not adversely affect roadless characteristics derived from these resources. Applying thinning or group select timber harvest to stands within the unroaded areas is not expected to affect the current ability for this area to function as a source of public drinking water to communities downstream.

Diversity of Plant and Animal Communities

Because of the heavily roaded condition of the project area, the proposed harvest units do not contain the diversity of plant and animal species that would be found in large, natural unmanaged stands where there would be no disturbance from roading and forest management activities. None of the action alternatives are expected to result in any decrease in such diversity of plant and animal species. The effects on sensitive plant and animal species are discussed elsewhere in this chapter.

Habitat for TES species and biological strongholds

No suitable habitat for the northern spotted owl would be either downgraded or removed within the unroaded areas (see the Threatened Northern Spotted Owl section). Effects on the spotted owl are consistent with Standards and Guidelines from the Willamette Forest Plan. Through informal consultation, the U.S. Fish and Wildlife Service concurs with the Biological Assessment, that the Bridge Thin Timber Sale would not jeopardize the continued existence of the spotted owl.

None of the proposed harvest units are located in Late Successional Reserves. Effects of the proposed units on the habitat for other Threatened, Endangered, or Sensitive species are also discussed elsewhere in this chapter.

The areas are not considered interior habitat because of the existing roaded condition of the project area. The proposed action is not expected to affect areas that would function as biological strongholds or refuges for species that depend on large undisturbed areas, such as the Threatened northern spotted owl.

Primitive, Semi-Primitive Non-Motorized Classes of Recreation

With clear evidence of past forest management, the landscape in the Bridge Thin Project is characterized as a patchwork of natural stands and second growth conifer plantations. As stated elsewhere in this chapter, the proposed partial cutting in this proposal, and the other action alternatives, would all remain within Forest Plan standards and guidelines for ROS and VQO, and would not adversely affect the existing scenic quality of the landscape.

Landscape Character and Scenic Integrity

There are limited opportunities for recreation activities that depend on remoteness and wilderness-like experiences in this area, as discussed elsewhere in this chapter (see Recreation and Scenic Quality). Roads are either visible or vehicles can be heard on roads from any location in the project area. Except for short term noise and traffic occurring during project implementation, the proposed action and other action alternatives would have not diminish any sense of remoteness or solitude that currently exist within any unroaded areas in the project area.

Traditional Cultural Properties and Sacred Sites

As discussed later in this chapter, there are no known cultural sites within any of the stands where timber harvest operations would occur, including managed stands within the unroaded areas. There would be no effect on traditional cultural properties or sites from the proposed action or any other action alternative.

Alternatives B and C—Cumulative Effects

The area of consideration for the unroaded area analysis is the 20,657 acre Bridge Thin Project Area. Timber sales have modified approximately 3,711acres within the project area with primarily regeneration harvest since the 1950s (see Table 13). Timber sales (and State and Federal Highway development) have also contributed to the development of a 115-mile network of roads on the area. As a result, there are now roughly 4,300 acres of contiguous unroaded areas 1,000 acres or more in size.

Both action alternatives would include approximately 216 acres of thinning and group select timber harvests within unroaded areas. No alternative includes permanent or temporary road construction within unroaded areas..

Considering past effects on unroaded areas by timber management, road development, and post-harvest treatment over the last 50 years, the thinning and group select timber harvests in both action alternatives would affect an additional 5% of the 4,300 acres considered unroaded and without management. No other management actions are planned for the project area that would result in additional affects to unroaded areas.

Social/Economics

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Social/Economic issues includes the project activity units is the Bridge Thin Project area and the surrounding communities that would be affected by the proposed project.

Affected Environment—Social/Economics

The Bridge Thin Project area is situated along Oregon State Highway 126, between the communities of Nimrod to the west, and McKenzie Bridge to the east. The communities of Blue River and Rainbow, Oregon are also located within or adjacent to the project area. Highway 126, a major travel route for commercial and recreation traffic passing through these communities, follows along the McKenzie River, bisecting the Bridge Thin project area.

The economy of the local communities from the Springfield urban-growth boundary to McKenzie Bridge depends on a mixture of tourism, recreation, timber industry, and Forest Service jobs for stability. Local businesses that rely on tourism and recreation include Hoodoo Ski Bowl, and the many inns, lodges, restaurants, stores, gas stations, and the outfitters and guides. Timber industry jobs include a variety of woods and mill jobs. Forest Service jobs in the Willamette and Deschutes National Forest vicinity are located at McKenzie Bridge, Sisters, Detroit, and Sweet Home Ranger Stations. Tourism and recreational activities connected with National Forest lands have been on the increase in recent years for the upper McKenzie River area. Employment connected with tourism and recreation-related services have also increased.

The current level of timber harvesting on the Willamette National Forest has dropped substantially from the levels of the mid-1980s. This decrease has contributed to a decline in the number of local jobs associated with the wood products industry in the area.

Environmental Consequences—Social/Economics

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

The no-action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy. Current levels of employment in the wood products sector would not be affected by this project.

Alternatives B and C—Direct, Indirect, and Cumulative Effects

All action alternatives are economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis run to make this determination is available in the Bridge Thin Project analysis file at the McKenzie River Ranger District office.

In general, the primary effect on timber harvest-related employment would occur from commercial timber harvest associated with the action alternatives over the next two to four years. As the alternative volume tables in Chapter 2 indicate, Both action alternatives would provide a relative moderate level of opportunity for timber harvest-related employment, and higher revenues. The proposed action, Alternative B, would provide slightly higher revenues than Alternative C. Table 36 discloses costs and revenues and the estimated present net value of each of the action alternatives, based on an average base period price of $39.19/CCF (100 Cubic Feet).

Though the combined economic benefit from implementation of any of the action alternatives is expected to be positive, each of the alternative from the Bridge Thin Project would have a moderate and localized beneficial effect for the socio-economic environment of western and central Oregon.

Table 36. Estimated Present Net Value of Alternatives.

	Alternative A No Action	Alternative B Proposed Action	Alternative C
Volume (MBF / CCF)	0	45,510 / 87,519	42,509 / 81,748
Discounted Costs	$0	$20,311,805.	$18,317,856
Discounted Revenues*	$0	$20,950230	$18,762,971
Present Net Value (PNV)	$0	$638,425	$445,116
PNV per Acre	$0	$338.87	$260.76
Benefit/Cost Ratio	0	1.0314	1.0243

* Discounted Revenues based on July 2008, selling values.

Heritage Resources

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Heritage Resources includes the project activity units in the Bridge Thin Project area.

Affected Environment—Heritage Resources

Archaeological materials recorded within the Bridge Thin project area represent Native American lithic scatters and historic period logging debris. The archeological sites within the project area are considered potentially eligible to the National Register of Historic Places (NRHP) and would be protected from project activities. The proposed Bridge Timber Sale has the potential to affect two of the known cultural sites within or near the project area. To protect these potentially eligible sites the project was redesigned by dropping portions of timber sale stands.

Prehistoric Use

Ethnographic research indicates that highly mobile prehistoric and early historic aboriginal groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purpose of seasonal hunting, fishing, and plant gathering.

Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be a montane-based band that were living in the western Oregon Cascades during the historic period. The Molala generally are known to be split into two subgroups: the Northern Molala located in the vicinity of Mount Hood's drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of a third group, referred to as the Upper Santiam/Santiam band of Molala known to have occupied Linn and Lane counties in areas between the Northern and Southern groups. The Molala are also often culturally grouped with the Kalapuya who were based in the Willamette Valley but probably made seasonal forays to the Cascades for large game and berries. Many of the Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molalla Treaties of 1855). Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath reservation to the south and east into Central Oregon where they were absorbed into the Confederated Tribes of Warm Springs Reservation of Oregon.

Flaked obsidian bifaces, flake tools, and lithic debris are the most abundant prehistoric Native American artifacts found in the area. These stone artifacts represent a range of activities, including stone tool production and use, which was generally related to hunting and gathering activities. Past and current stone tool analyses support the previously noted position that this portion of the Cascades was occupied primarily by highly mobile people indigenous to the Cascades.

Historic Land Use

Historic accounts document the presence of horse-mounted Warm Springs Indians traveling into and through the area in the late 1800s and early 1900s (Williams 1988); these seasonal travels were motivated by the need for forage for horses, huckleberry gathering, inter-tribal contacts and visiting, hunting, fishing, trading with white settlers, and travel to seasonal cash employment, such as picking hops in the Willamette Valley (Williams 1988; Bergland 1992).

The earliest recorded permanent Euro American settler in the area was John Templeton Craig, who homesteaded at Craig's Pasture (now McKenzie Bridge) in the 1860s. The prospect of a toll road over the McKenzie Pass began to draw settlers into the area after 900 cattle and nine wagons made it over the pass on a rough track (the Scott Wagon Road) in the fall of 1862 (Williams 1988).

The town of Blue River was founded in 1886 (Williams 1988). Subsistence hunting, farming, and stock raising were the primary lifestyles of the early settlers. A greater influx of people into the area was encouraged by the passage of the Forest Homestead Act in 1906, which allowed homesteaders to claim land set aside as national forest. The first sawmill in the region was opened on the lower McKenzie in 1851 however systematic logging of huge tracts of forest did not occur until the 1890s.

Historic Administrative use appears in the form of trails and early logging activity. The Santiam NF Maps (1913, 1931) and the Cascade National Forest 1925 map depict several historic or prehistoric trails crossing through the project area. These include the Castle Rock Trails and trails to Deathball Rock and Thors Hammer. Several historic structures clustering around the Blue River, McKenzie

Bridge, and Rainbow areas are visible on Forest Service maps dating back to the 1920s. A historic ranger station at McKenzie Bridge, along with the Paradise and Blue River Guard stations, is also noted on Forest Service maps between 1913 and 1931. The Belknap CCC camp was located at the present site of the McKenzie River Ranger Station (Gauthier et. Al 2007).

Environmental Consequences—Heritage Resources

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Under Alternative A, no effects to cultural resources are expected since no ground disturbance activity would occur.

Alternatives B and C—Direct and Indirect Effects

Both action alternatives for the Bridge Thin Project would result in ground disturbance over 25,500 feet of temporary road and 34 miles of road maintenance. Ground disturbance related to harvest activities would be slightly greater in Alternative B (approximately 2,256 acres) than Alternative C (approximately 2,080 acres), which would produce slightly greater amounts of potential disturbance. Since appropriate and approved surveys and cultural site protection measures are already in place for this project, the potential direct effects would be in the form of inadvertent damage to the integrity of cultural resources which were not discovered during initial survey. Any sites identified during implementation of the project would require the application of mitigation measures described in Chapter 2.

Alternatives B and C—Cumulative Effects

There are no known additional incremental effects to cultural resources from implementing either action alternative. There are also no foreseeable future management activities within the Bridge Thin Project area involving ground disturbing activities that could add to the cumulative effects of past management in the area.

Compliance with Other Laws, Regulations and Executive Orders

This section describes how the action alternatives comply with applicable State and Federal laws, regulations and policies.

State Laws:

Oregon State Scenic Waterway – Segments of the McKenzie River within this project area are also in portions of the Oregon State Scenic Waterway, which is administered by the Oregon State Parks and Recreation Department. The State Scenic Waterway segments have a dual classification, with the west side of the McKenzie River is classified as Scenic River Area and the east side of the river classified as Recreation River Area. Scenic Waterway Act and Commission rules require the evaluation of proposed development within ¼ mile from each side of the river.

No timber harvest or any other actions are proposed within the State Scenic Waterway-Scenic River Area.

Federal Laws and Executive Orders:

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act as amended, October 1966 – Before project implementation, State Historic Preservation Office consultation is completed under the Programmatic Agreement among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer regarding Cultural Resource Management on National Forests in the State of Oregon, dated June 2004. Field surveys where ground-disturbing activities would occur in the Bridge Thin Project area have been completed. All known archaeological sites in the project area are protected by avoidance.

Should previously unknown sites be found during ground disturbing activities, contract provisions would provide protection and the McKenzie River District Archaeologist would be immediately notified.

These various measures resulted in a determination of **No Historic Properties Affected**. Because cultural resources would not be affected by proposed activities under any action alternative.

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects of the proposed action on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl, and for the bull trout, and spring Chinook salmon.

Clean Air Act Amendments, 1977 – The alternatives are designed to meet the National Ambient Air quality standards through avoidance of practices that degrade air quality below health and visibility standards. This project is consistent with by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments (see Fire and Fuels).

The Clean Water Act, 1987 – This act establishes a non-degradation policy for all federally proposed projects. Compliance with the Clean Water Act would be accomplished through planning, application and monitoring of Best Management Practices (BMPs).

There are no streams in the Bridge Thin Project Area listed by Oregon Department of Environmental Quality as 303(d), as water quality limited based on water temperature during the summer season. (See Water Quality/Riparian Resources).

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Development of Rock Quarrys would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – The Bridge Thin Project area is located in the McKenzie River Watershed, which is included in the waters designated as Essential Fish Habitat for spring Chinook salmon by the Pacific Fishery Management Council (PFMC). The proposed action is not likely to adversely affect aquatic systems, recreational fisheries, or designated Essential Fish Habitat (see Chapter 3, Water Quality/Aquatic Resources.)

Wild and Scenic Rivers Act, 1968 – Alternatives in this proposal are designed to maintain the Outstandingly Remarkable Values of the McKenzie River Wild and Scenic River. Moderate partial cutting in unit 3 (41 acres) is included within this Congressionally Reserved designation. However, timber harvest as prescribed is consistent with the allowable timber harvest specified in the McKenzie River Wild and Scenic River Plan (USDA Forest Service 1993). See Scenic Quality.

Inventoried Roadless Areas and Wilderness – There are no actions proposed within Inventoried Roadless Areas (IRAs) or Wildernesses in the Bridge Thin Project, and no actions would affect these designations.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Proposed harvest treatments would not occur within 100-year floodplains.

Executive Order 11990 –requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian reserves, seeps, springs, and other wet habitats exist in the Bridge Thin Project Area. These areas would be either avoided, or managed according to Riparian Reserve Management Guidelines in Chapter 2 to comply with amended Willamette Forest Plan Standards and Guidelines. Riparian reserves would also be protected with Mitigation Measures also detailed in Chapter 2. As a result, proposed harvest treatments would be consistent with Executive Orders 11988 and 11990.

Executive Order 12898: Environmental Justice – Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of the proposed action or any of the alternatives, there would be no disproportionately high and adverse human health or environmental effects on minority or low-income populations. The actions would occur in a remote area, and nearby communities would mainly be affected by economic impacts connected with contractors implementing harvest, road reconstruction, tree thinning, planting, fuels treatment activities. Racial and cultural minority groups could also be prevalent in the work forces that implement timber harvest, road reconstruction, tree thinning, planting, and fuels treatment activities. Contracts contain clauses that address worker safety.

Executive Order 12962: Recreational Fishing – The June 7, 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation and provide for more and better recreational fishing opportunities, and to develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and to develop a comprehensive Recreational Fishery Resources Conservation Plan.

Executive Order 13186: Neotropical Migratory Birds – There are 85 bird species recognized as neotropical migrants on the Willamette National Forest. Thirty-five of these species found on the Willamette have been identified as species of concern (Sharp 1992). A Memorandum of Understanding was signed between the USFS and USFWS to complement the January 2001, Executive Order.

The Bridge Thin Project Area contains populations of migratory landbirds typical of the western Cascades. See Migratory Landbird above for further discussion of effects on neotropical migratory birds.

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Bridge Thin Project EA was done in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 –All proposed timber harvest units are planned to occur on suitable land. If regeneration harvest is implemented the sites would be capable of restocking within 5 years of harvest by either natural or artificial means. All units were considered for potential uneven-aged management. Proposed commercial thinning would increase the rate of growth of remaining trees. Some locations would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Mitigation measures have been identified to protect site productivity, soils, and water quality.

The burning of activity fuels would reduce long-lasting hazards from wildfire over the project area as a whole, while air quality would be maintained at a level that would meet or exceed applicable Federal, State, and local standards. All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife. Critical habitat for threatened or endangered species would be protected through avoidance. The alternatives include proposed actions that accelerate development of forest habitats that are currently deficient within the analysis area to enhance the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Forest Plan Consistency – Actions analyzed in the Bridge Thin EA are consistent with a broad range of Forest Plan Standards and Guidelines that have been discussed and disclosed throughout the document. The timber stand treatments associated with the Bridge Thin Project are consistent with the goals and management direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and Record of Decision. Road improvements that address watershed restoration needs are designed to be consistent with the 1994 Northwest Forest Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the Bridge Thin Project Area. The Oregon Department of Fish and Wildlife is responsible for management of fish and wildlife populations, whereas the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis.

Proposed harvest treatments within riparian areas have been designed to comply with "Sufficiency Analysis for Stream Temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry, and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon's Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for proposed projects requiring use of mechanized equipment: Commercial thinning and some partial cutting units would involve both heavy and small machines for yarding logs during the implementation period. Projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy consumption. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to a supply of energy for the local community for home heating.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the analysis area.

Unavoidable Adverse Effects – Implementation of any of the alternatives, including the No Action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions and Standards and Guidelines in Chapter IV of the Willamette Forest Plan, and additional Mitigation Measures and Design Measures proposed in Chapter 2 of this document. These adverse environmental effects are discussed at length under each resource section.

Irreversible and Irretrievable Effects – “Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

No new construction of permanent roads is planned. Temporary road would be constructed, but would be obliterated following operations. Log landings would produce irretrievable changes in the natural appearance of the landscape as well. Rock used to surface roads would be an irreversible commitment of mineral resources.

The soil and water protection measures identified in the Forest Plan Standards and Guidelines, Mitigation and Design Measures in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed actions would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

With all Action Alternatives (B and C)*:* Tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. Log landings would produce irreversible changes in the natural appearance of the landscape. The visual effect of log landings would be somewhat reduced by mitigation measures and design measures to reduce soil compaction and erosion (scarification, seeding and waterbarring for example). Little irreversible loss of soil should occur due to extensive mitigation associated with timber harvest and prescribed fire (tractor harvest only on slopes less than 35 percent, skyline yarding with partial or full suspension to meet Forest Plan Standards and Guidelines, etc.).

With Alternative A (No Action): There would be an irretrievable loss of growth within the untreated, overstocked forest. The ability to protect forest within the analysis area from catastrophic fire could be irretrievably lost as well. There would be the potential for irreversible loss of timber value due to declining tree diameter growth related to crowded stand conditions, and loss of potential growth from insects and disease.

Monitoring

Invasive Plants

Post-sale invasive plant surveys would be completed by District personnel as a mitigation measure to determine if the weed treatments were effective. The monitoring survey would occur one year after treatments with results reported to the district Botanist. Bermed and decommissioned roads would be monitored for Invasive Plants for three years after the road treatment is completed. Follow up treatments would occur if necessary.

Logging Operations

During logging, operations would be monitored for adherence to contract specifications including thinning specifications, bole damage to residual trees, retention of down wood and snags, skid trail spacing and use of designated skid trails. Contract compliance monitoring would be performed by Timber Sale Administrators.

Reforestation

First, third and fifth year survival/stocking examinations to monitor seedling survival, natural regeneration, animal damage and need for release or replanting within planted groups would be conducted for harvested stands.

Forest Plan Implementation Monitoring

A district timber sale review with the District Ranger, IDT Members and Resource Specialists would be conducted within one year of timber sale completion to determine if the prescribed treatments were successfully applied. The effectiveness of the prescribed treatments would be evaluated, providing valuable information for future projects. The Forest Supervisor's Staff performs annual project monitoring at each Ranger District, and compiles the results in the yearly Forest Monitoring Report. Timber sales from this project would be likely candidates for Forest Plan Implementation monitoring. Post-harvest stand density would require sampling of units prior to monitoring. Other implementation monitoring subjects may include temporary road decommissioning, system road closures and decommissioning for watershed restoration.

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Chapter 4. Consultation and Coordination

The Forest Service consulted with Federal, State, and local agencies; with tribal organizations; and individuals known to have an interest in similar projects during the development of this EA. Refer to Public Involvement on page 14 of Chapter 1.

On May 18, 2007 a scoping letter was mailed to following:

Federal, State, and Local Agencies:

- McKenzie Watershed Council
- Oregon Dept. of Fish and Wildlife
- U.S.D.I. Fish and Wildlife Service
- Sid Leiken, Mayor, Springfield City Council
- Karl Morgenstern, Source Water Protection Manager, Eugene Water and Electric Board
- Steve Newcomb, Environmental Coordinator, Eugene Water and Electric Board
- Kitty Piercy, Mayor, Eugene City Council

Tribal Governments:

- Sally Bird, Confederated Tribes of Warm Springs
- Bobby Brunoe, Confederated Tribes of the Warm Springs
- Allen Foreman, The Klamath Tribe
- Cheryle Kennedy, Confederated Tribes of the Grande Ronde
- Mike Kennedy, Confederated Tribes of the Siletz Indians
- Robert Kentta, Confederated Tribes of the Siletz Indians
- Chris Leno, Confederated Tribes of the Grande Ronde
- David Lewis, Confederated Tribes of the Grande Ronde

Tribal Governments

- Chris Mercier, Confederated Tribes of Grand Ronde
- Elwood Miller, Klamath Tribe Natural Resources
- Jeff Nepstad, Confederated Tribes of the Grande Ronde
- Clay Penhollow, Confederated Tribes of Warm Springs
- Delores Pigsley, Confederated Tribes of the Siletz
- Gerald Skelton, Klamath Tribe Cultural Resource
- Ron Suppah, Confederated Tribes of Warm Springs
- Pete Wakeland, Confederated Tribes of the Grande Ronde

Elected Officials:

- County Commissioners, Lane County
- County Commissioners, Linn County

Organizations and Individuals:

- Jim Baker, McKenzie Guardians
- Jim Berl, Oregon Guides and Packers
- Roger Borine, Oregon Hunters Assoc.
- Linda Christian
- Terry Damon, Rosboro Lumber Co.
- Fred Dutli
- Ken & Louise Engelman, River Reflections
- Forest Conservation Council

Organizations and Individuals:

- Michael Godfrey
- Griffin Green, Mt. Jefferson Snowmobile Club
- Jake Groves, American Forest Resource Council
- Robert and Michele Hiddleston
- Jim and Nancy Holland
- Chandra LaGue, Oregon Wild
- Josh Laughlin, Cascadia Wildlands Project
- Conservation Leader, Lane Co Audubon Society
- Joan and Hector Leslie
- Steve and Kathy Keable
- Chairperson, Forest Issue, Many Rivers Group, Sierra Club

Manager, McKenzie River Chamber of Commerce

- Jim Todd, Oregon Nordic Club, Willamette Chapter
- Conservation Chair, Obsidians
- Craig Patterson
- Greg Pitts, Oregon Council, Federation of Flyfishers
- Cheryl Russell
- Annette Simonson, Santiam Wilderness Committee
- Eugene Skrine
- Andy Stahl, FSEEE
- Doug Waddell

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Cara Kelly, Archaeologist
Dave Kretzing, Hydrologist
Mei Lin Lantz, Fire and Fuels Specialist
Adrienne Launer, Civil Engineering Tech
Kate Meyer, Fisheries Biologist
Steve Otoupalik, Recreation
Ray Rivera, Fisheries Biologist
James Rudisill, Silviculturist
Doug Shank, Forest Geologist
Burtchell Thomas, Botanist

Appendices

Appendix A – Aquatic Conservation Strategy Consistency

Appendix B – Biological Assessment, Spring Chinook Salmon and Bull Trout

Appendix C – Biological Evaluation, Botany

Appendix D – Biological Assessment & Biological Evaluation, Wildlife

Appendix E – Soils Specialist Report

Appendix F – Fuels Specialist Report

Appendix G – Heritage Resources Specialist Report

Appendix H – Response to Comments

Appendix I– Cumulative Effects

United States
Department of
Agriculture

Forest Service

March 2008

Environmental Assessment

Bridge Thin Project

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McKenzie River Ranger District
Willamette National Forest
Lane County, Oregon

Legal Locations: Within T.15S, R.4E, T.15S, R.5E, T.16S, R.4E, T.16S, R.5E;

Willamette Meridian

For Information Contact: **Shane Kamrath, Project Leader**
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McKenzie Bridge, Oregon 97413
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Appendices

Appendix A – Aquatic Conservation Strategy Consistency

Appendix B – Biological Assessment, Spring Chinook Salmon and Bull Trout

Appendix C – Biological Evaluation, Botany

Appendix D – Biological Assessment & Biological Evaluation, Wildlife

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APPENDIX A

An Evaluation of Activities Authorized by the Bridge Thin Project Environmental Assessment for Consistency with the Aquatic Conservation Strategy

Introduction

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy. A variety of tactics to accomplish these goals and objectives are incorporated into four primary components. These components are:

- **Riparian Reserves**
- **Key Watersheds**
- **Watershed Analysis**
- **Watershed Restoration**

These four components, along with Late Successional Reserves, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - USFS, BLM 1994, (ROD), pages B9-B12).

The Four Components

1. Riparian Reserves

The Northwest Forest Plan defined Riparian Reserves as “portions of watersheds where riparian-dependant resources receive primary emphasis and where special standards and guidelines apply” (ROD page B12). Riparian Reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water bodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats (ROD pgs. B-12 and B-13).

The Quartz Creek and Minor Tributaries Watershed Analysis (Willamette N.F. - 1998) (WA) made no recommendations to adjust riparian reserve widths for the streams in the watershed, retaining the initial reserve widths from the ROD for all streams

During the analysis for the Bridge Thin project, no reductions of riparian reserve widths along any streams were proposed.

2. Key Watersheds

The Northwest Forest Plan created an overlay of Key Watersheds that are intended to provide refugia for at-risk stocks of anadromous salmonids and resident fish species. Refugia are a cornerstone of the conservation strategy for these species, consisting of watersheds that provide high quality habitat or are expected to provide habitat. Two different levels of protection, or tiers, are identified, as well as non-Key watersheds (ROD page B19). In key watersheds, completion of a watershed analysis is required prior to most management activities. The Bridge Thin project area falls exclusively within non-Key Watershed designated lands.

3. & 4. Watershed Analysis and Watershed Restoration

The Quartz Creek and Minor Tributaries Watershed Analysis (WA) was prepared for the Blue River Ranger District in 1998. The watershed was characterized in terms of past and current conditions, and a synthesis discussion was provided to guide development of management proposals to maintain and restore watershed conditions

The Bridge Thin Project has incorporated information from the WA into the project design. Current vegetative landscape patterns reflect past management activities that did not consider what the landscape might look like under natural disturbance regimes. Many of the proposed projects seek to create vegetative patterns, late successional stand structures, and fuel loadings that would have been typical of this landscape under the natural fire disturbance regimes that historically occurred in the area.

Aquatic Conservation Strategy Objectives

The previous discussions highlighted the consistency of the Bridge Thin Project with the four components of the Aquatic Conservation Strategy. This section will outline how the activities proposed in the action alternatives conform to the nine objectives of the ACS. The information presented is summarized from Chapters 2 and 3 of the Environmental Assessment, where greater detail can be found, if needed.

Objective #1

Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Harvest and prescribed fire prescriptions for proposed units were developed so that the treatment would, to the extent possible, resemble the effects of the natural fire regime that historically occurred in the vicinity of each unit. The objectives for the treatments are to develop stand structures that will maintain existing habitat, while creating conditions resembling those that would occur in the presence of the historic natural fire regime. Specific treatments are also included to enhance big game habitat and to restore oak savannah habitat that has been declining as a result of past fire suppression activities

This will provide a balance between the maintenance of existing habitat for species, populations, and communities, with opportunities to develop landscape scale features with distribution, diversity and complexity typical of landscapes that developed under fire regimes that historically occurred in the area. This includes aquatic and riparian elements of the landscape.

Objective #2

Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Riparian reserves, as established by the Record of Decision for the Northwest Forest Plan and re-assessed in the Quartz Creek/ Minor Tributaries Watershed Analysis have been incorporated into the design of all treatment units where streams occur. Treatments are proposed within riparian reserves, where they have the potential to enhance functions such as the development of future large wood, stand structural diversity, vegetative species richness and diversity and other late successional characteristics. Road treatments include upgrade of stream crossings to accommodate 100 year flood events, so that these events can flow through the landscape unimpeded and without the risk of catastrophic fill failures. Where needed, these crossings will be retrofitted to permit passage of fish, amphibian, and other aquatic and riparian species to and from wetland habitat located both upstream and downstream from the crossing.

Objective #3

Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

All harvest treatments restrict the use of ground disturbing equipment in and around streams, and provide for retention of all vegetation that is contributing to the stability of banks and channels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Bridge Thin Project addresses this concern, by minimizing road construction in all alternatives. The only new roads to be constructed are temporary roads located on stable locations, and all of these will be obliterated following harvest activities.

Reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms.

Objective #4 *and* Objective #5

Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities. *And*

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Project design elements intended to maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, as discussed above under Objective 3 provide protection to water quality from the introduction of sediment into streams and resulting effects on stream turbidity. Many of the roadwork projects and the scuba access proposal will reduce or eliminate existing sources of sediment induced turbidity.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Bridge Thin Project addresses this concern, by minimizing road construction in all alternatives. The only new roads to be constructed are temporary roads located on stable locations, and all of these will be obliterated following harvest activities. No stream crossings are proposed.

Reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms.

In addition, where beneficial vegetative treatments are proposed within riparian reserves, effective stream shading in compliance with the Regional TMDL Implementation Strategy is retained so that stream temperatures are not impacted

Objective #6 *and* Objective #7

Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The

timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.
And
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Implementation of a landscape design that is intended to restore vegetative structures, landscape patterns, and disturbance regimes to a more natural condition will result in watershed conditions that more closely resemble those under which historic stream flow conditions developed.

In the short term, potential adverse effects on the timing, magnitude, duration, and spatial distribution of peak and high flows will be minimized by managing the planning sub-drainages within the analysis area to Aggregate Recovery Percentage (ARP) levels that comply with the Willamette National Forest Land and Resource Management Plan, (Willamette National Forest, 1990)

Floodplains and wetland areas were excluded from consideration for harvest activities and where treatment units occur adjacent to these features, ground based equipment that could impact the soil and result in altered ground water movement are restricted.

Objective #8

Maintain and restore the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Harvest and prescribed fire prescriptions for proposed units were developed so that the treatment would, to the extent possible, resemble the effects of the natural fire regime that historically occurred in the vicinity of each unit. The objectives for the treatments are to develop stand structures that will maintain existing habitat, while creating conditions resembling those that would occur in the presence of the historic natural fire regime.

This will provide a balance between the maintenance of existing habitat for species, populations, and communities, with opportunities to develop landscape scale features with distribution, diversity and complexity typical of landscapes that developed under fire regimes that historically occurred in the area. This will create conditions that favor development species composition and structural diversity of plants across the landscape of the Bridge Thin Project Area, including riparian areas and wetlands.

Stands in riparian reserves are proposed for treatment to encourage development of large wood and late successional stand structure, where possible to do so without risk to bank and channel stability, and where effective stream shade can be retained to provide thermal regulation.

Wetlands and floodplain areas that are critical to nutrient filtering are eliminated from treatment areas and use of ground disturbing equipment adjacent to them is restricted.

Use of low severity fire is restricted to portions of riparian reserves where the risk of adverse effects on ground cover and duff retention cannot impact water quality. However, portions of riparian reserves that will be treated are expected to develop a more diverse pattern of small openings and patches, and a richer vegetative species composition and diversity.

Objective #9

Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Implementation of a landscape design that is intended to restore landscape processes, vegetative structures, and landscape patterns to more natural conditions, will restore the ability of the landscape to create a rich variety of habitats for native species.

In addition, this project complies with the Northwest Forest Plan, and all of its applicable standards and guidelines. Option 9 was expected to maintain and restore late-successional and old-growth forest ecosystems, and provide adequate viability levels for all late successional species including species listed in the FSEIS ROD Table C-3. The Watershed Analyses for the McKenzie River/Quartz Creek Watershed (Quartz Creek/Minor Tributaries WA) did not identify any need for increased protection above the ROD recommendations. Adequate amounts of down woody debris will be retained on site. This project will not affect the amount or distribution of these habitats or species that use these habitats.

BIOLOGICAL ASSESSMENT

Project Name:
Bridge Thin Project

NEPA Document Name:
Bridge Thin Environmental Assessment, Draft

Watershed Analysis:
Quartz Creek and Minor Tributaries, Willamette National Forest, 1998

Other ESA Consultation:
Formal and informal consultation on FY 2007-2008 projects within the Willamette Planning Province which may affect bald eagles, northern spotted owls, and/or spotted owl critical habitat due to habitat modification and disturbance [FWS *reference*: 1-7-06-F-0179 and 1-7-06-I-0192].

Administrative Unit:
Willamette National Forest, McKenzie River Ranger District

Prepared By:
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Reviewed By:
Wade Sims, ESA Consultation Biologist (Fisheries), Willamette N.F.

Date Sent For Electronic Review:
January 14, 2008

ESA Unit, Critical Habitat, and EFH Addressed in this BA:

LISTED SPECIES or HABITAT	ESA STATUS	ESA / EFH DETERMINATION
Upper Willamette River Chinook Salmon - Evolutionarily Significant Unit (ESU)	Threatened	May Affect, Not Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Critical Habitat	Designated	May Affect, Not Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Essential Fish Habitat	Designated	Will Not Adversely Affect
Columbia River Bull Trout – Distinct Population Segment (DPS)	Threatened	May Affect, Not Likely to Adversely Affect
Columbia River Bull Trout – Critical Habitat	Designated	May Affect, Not Likely to Adversely Affect

Project Location:

USGS HYDROLOGIC UNIT CODE (HUC)	HUC SCALE	HUC NAME	NW Forest Plan Key Watershed
17090004	HUC4	McKenzie River	No
1709000405	HUC5	McKenzie River/ Quartz Creek	No
170900040502	HUC6	McKenzie River / Elk Creek	No

Table of Contents

I. INTRODUCTION

The McKenzie River Ranger District of the Willamette National Forest proposes to thin approximately 2,502 acres of previously managed stands up to 80 years of age (2,096 acres) and fire regenerated stands up to 120 years (406 acres) within the McKenzie River/Elk Creek 6th Field subwatershed. The purpose of the action is to improve stand conditions in terms of species composition, density, and structure over the long term.

The Bridge Thin Project is located in a watershed currently providing habitat for spring Chinook salmon (*Onchorhynchus tshawytcha*) in the Upper Willamette Evolutionarily Significant Unit. This species is listed as Threatened and is protected under the Endangered Species Act. This Biological Assessment (BA) evaluates the effects the project may have on this fish, its habitat or designated Critical Habitat, and evaluates the effect of the project on Essential Fish Habitat (EFH) as designated by the Magnuson-Stevens Fishery Conservation and Management Act.

The Bridge Thin Project is in a watershed that also provides habitat for bull trout (*Salvelinus confluentus*), part of the Columbia River population segment that is listed as Threatened and protected under the Endangered Species Act of 1973 (as amended). On June 13, 1997, the US Fish and Wildlife Service published in the Federal Register (62 FR 32268) a proposed rule to list the Klamath River population segment of bull trout as an endangered species, and the Columbia River population segment of bull trout as a threatened species. On June 10, 1998, a final rule was published in the Federal Register (63 FR 31647) determining the Klamath River and Columbia River population segments of bull trout to have Threatened status under the Act. At the time of listing, the Service, made the finding that critical habitat was not determinable for these populations because their habitat needs were not sufficiently well known (63 FR 31647). For a further summary of previous Federal actions, see 64 FR 58916.

On January 26, 2001, the Alliance for the Wild Rockies, Inc. and Friends of the Wild Swan, Inc. filed a lawsuit in the U.S. District Court of Oregon challenging the Service's failure to designate critical habitat for bull trout. A settlement agreement was reached on January 14, 2002, which stipulated that the Service would make critical habitat determinations for the five population segments of bull trout (Civil Case No: CV 01-127-JO). For the Klamath River and Columbia River populations, the Service agreed to submit for publication in the Federal Register a proposed rule for critical habitat designation by October 1, 2002, and a final rule by October 1, 2003. A subsequent agreement resulted in extending the date for the publication. The proposed rule was printed in the Federal Register November 29, 2002 and the final critical habitat designation (70 FR 56212) was published September 26, 2005.

This BA was prepared in accordance with the following guidance and direction:

- Analytical Process (AP) for Development of Biological Assessments for Consultation on Federal Actions Affecting Fish Proposed or Listed Under the Endangered Species Act Within the Northwest Forest Plan Area (Interagency Guidelines, November 2004),
- Endangered Species Act of 1973 (as amended),

  50 CFR § 402.12 (Interagency Cooperation, Biological Assessments),
- Endangered Species Consultation Handbook (USFWS and NMFS, March 1998),
- Streamlined Consultation Procedures for Section 7 of the Endangered Species Act (FS, NMFS, BLM, & USFWS, July 1999), and

- Magnuson-Stevens Fishery Conservation and Management Act (§ 305(b)) and its implementing regulations (50CFR § 600).

NOAA Fisheries has worked with the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Forest Service (FS) to revise the methods for making determinations of effect for land management activities impacting ESA-listed salmonid species in the Northwest Forest Plan geographical area. This new approach was used to assess the effects of the proposed action. In this regard, the elements of the proposed action were analyzed for potential effects on the Upper Willamette Spring Chinook Salmon and Columbia River Bull Trout due to changes in the habitat pathways of water quality, habitat access, habitat elements, channel conditions and dynamics, flow/hydrology, and watershed conditions. In applying the revised analysis approach, the agencies consider eight factors, derived largely from the joint NOAA Fisheries and Fish and Wildlife Service ESA Section 7 Consultation Handbook, when evaluating the effects of an action on habitat indicators and subsequently the effects on ESA-listed fish. These factors are proximity, probability, magnitude (severity and intensity), nature, distribution, frequency, duration, and timing, where applicable.

This analysis considered the potential direct and indirect effect of the project's elements on each habitat indicator and then utilized the relevant factors to determine if there was an effect and whether it was measurable, insignificant, discountable, or beneficial. A summary for each habitat indicator was developed to ascertain whether effects from various elements combine to create negative effects on any of the indicators. These effects, and those of interrelated or interdependent actions to the proposed action, were considered to reach an overall effect determination for this project. The effects of other concurrent Federal actions are disclosed to provide information to assist the Services in their jeopardy and destruction/adverse modification of critical habitat determinations.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Purpose and Need

The need for action in the project area was established from analysis of stand conditions of the Bridge Thin planning that has occurred over several years and was completed in 2007. Even-aged management as well as wildfires with fire suppression over the last several decades, has created stands that lack the structural and species diversity that would otherwise have developed. Stand data shows that the maximum stand density index (SDI) levels are predominantly above 50%, levels at which the limit of tree vigor is reached and overall stand health and tree vigor begin to decline. The purpose of this project is to apply silvicultural and fuels treatments to these stands to maintain or improve tree growth and vigor; to reduce the mortality that occurs in high-density stands when resources important to tree survival become limiting; to improve stand conditions in terms of species composition, density, and structure over the long term; to return the role of fire as a natural disturbance process in the ecosystem; and to improve defensible space within the wildland-urban interface in stands ranging from 80 to approximately 120 years of age. Stand treatments will occur in stands that have resulted from previous even-aged management in addition to fire regenerated stands where management has been limited to selective harvest.

Included in the purpose of the proposed action is to implement the Record of Decision (ROD) for the Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA, 1994). This document, which is better known as the Northwest Forest Plan (NWFP), established the standards and guidelines for activities on Federal Land.

The Willamette National Forest Land and Resource Management Plan, as amended by the NWFP, includes resource management goals to maintain or enhance forest conditions at the stand and landscape level: high quality water resources; aquatic habitat for fish, and terrestrial habitat diversity for wildlife and plants; scenic quality; and to provide timber products. The Forest Service is directed to meet these goals when planning projects at the site-specific level. Therefore, actions taken to meet the purpose and need shall be guided by the following objectives:

- Restore structural diversity in stem exclusion stands to enhance wildlife habitat;
- Accelerate late-successional conditions for stands within riparian reserves;
- Restore “open oak savannah” stands where they were historically present;
- Restore degraded roads infrastructure;
- Protect and maintain beneficial uses in the watershed for communities in the wildland-urban interface;
- Reduce hazardous fuels and improve the role of fire as a natural disturbance process in the ecosystem.

The following Figures in Appendix A illustrate project area:

- Figure A-1. Project Location
- Figure A-2. McKenzie River/Elk Creek Sub-watershed
- Figure A-3. ESA Fish Distribution

B. Project Elements

This project has been separated into six project elements which are described in detail below:

1) **Timber Felling,**
2) **Timber Yarding,**
3) **Timber and Rock Hauling,**
4) **Road, Rock Pit and Landing Work,** (including stream culvert replacement, road construction, reconstruction and maintenance, landing construction, and road decommissioning and closure),
5) **Fuels Treatment**

1) Timber Felling

The Bridge Thin Project proposes to commercially thin and selectively harvest approximately 2,502 acres within the Northwest Forest Plan Adaptive Management Area land allocation, yielding about 35.5 million board feet of timber products. Thinning treatments in managed stands up to 80 years of age (approximately 2,096 acres) and fire regenerated stands up to 120 years (approximately 406 acres) would occur during FY2008-2012. Oak savanna restoration on approximately 51 acres would remove encroaching trees to restore a more open condition for this unique habitat. Thinning for elk habitat enhancement would occur on approximately 237 acres, and non-commercial fire hazard reduction would occur on approximately 178 acres.

After intensive stream reconnaissance of the action area, a thinning strategy to meet project objectives was developed (Table 1), which includes no-harvest and no-fuel-treatment buffers to protect water quality and habitat conditions. In previously unmanaged and fire regenerated stands ranging from 95 to 120 years old, there will be a 300 foot no-harvest buffer (2 site potential tree heights) on all fish-bearing streams (including bull trout and spring Chinook bearing streams), with a sixty foot no-treatment buffer in units selected for fire hazard reduction only (no commercial harvest). In unmanaged stands selected for thinning, there will be a 150 foot no-harvest buffer on perennial non-fish bearing streams and a 30 foot no-harvest buffer on intermittent streams. In unmanaged stands selected for oak savannah restoration and elk habitat enhancement, there will be a 60 no-harvest buffer (with 50% canopy closure from 60 – 150 feet) on perennial streams and a 30 foot no-harvest buffer on intermittent streams. In stands selected for fire hazard reduction only, there will be a 30 foot no-treatment buffer on both perennial and intermittent streams. Lakes and wetlands will have 300 foot and 150 foot no-harvest buffers, respectively, in all harvest stands and a 60 foot no-treatment buffer in fire hazard reduction only stands.

In previously managed stands ranging from 32 to 80 years old, there will be a 60 foot no-harvest buffer on all perennial and fish-bearing streams (with 50% canopy closure from 60 – 300 feet on fish-bearing streams and 50% canopy closure from 60 – 150 feet on non fish-bearing streams), and a 30 foot no-harvest buffer on intermittent streams. Lakes and wetlands will have 300 foot and 60 foot no-harvest buffers, respectively. In stands selected for fire hazard reduction only, there will be a 60-foot no-treatment buffer on fish-bearing streams and a 30 foot no-treatment buffer on non fish-bearing perennial and intermittent streams (Table 1).

The site-potential tree height for the project area is 150 feet. Riparian reserves for fish-bearing streams are 300 feet on both sides and 150 feet for non fish-bearing perennial and intermittent streams. The no-harvest buffers in unmanaged stands on fish-bearing streams (300 feet) include all of the inner gorge and the entire primary and secondary shade zones. The no-harvest corridor retains all of the floodplain as defined by riparian indicator plants for streams lacking a clearly defined inner gorge. Adjacent trees would be felled away from the no-harvest buffer. Trees felled within the no-treatment buffer for skyline corridors would be left on-site (see Timber Yarding for details). Fuel treatment units are located 150 feet from LFH are along the McKenzie River, which has an average wetted width of approximately 100-200 feet.

Timber harvest activity has the potential to affect stream temperature through modification of canopy. In thinning riparian reserves to accelerate stem diameter, prescribed distances to channels were developed in part to minimize potential temperature impact to year-round waterways, using the guidance provided in Northwest Forest Plan Temperature TMDL Implementation Strategies” (USDA Forest Service and USDI BLM, 2005). The following table summarizes riparian reserve thinning prescriptions, designed to minimize potential temperature and sediment impacts to aquatic habitat. (Equipment proximity to channels and potential to generate sediment was also a consideration in developing riparian reserve management prescriptions described below.)

Table 1. Riparian Reserve Management for Bridge Thin.

	Timber Harvest – Thinning and Group Selection (Includes activity fuel treatment)	Timber harvest - Savanna Restoration and Wildlife Habitat Enhancement (Includes activity fuel treatment)	Fire Hazard Reduction (No harvest – removal of ladder fuels and stems <7”)
<u>Previously Managed Stands</u> (Units 1-72)	Fish-Bearing Streams (Class 1 and 2) - 60' NH, 50% canopy closure from 60’-300' Perennial, Non Fish-Bearing Streams (Class 3) - 60' NH, 50% canopy closure from 60’*-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes - 300' NH Wetlands - 60' NH	Fish-Bearing Streams (Class 1 and 2) - 60' NH, 50% canopy closure from 60’-300' Perennial, Non Fish-Bearing Streams (Class 3) - 60' NH, 50% canopy closure from 60’*-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes – 300' NH Wetlands – 60' -.NH	Fish-Bearing Streams (Class 1 and 2) – 60' NT Perennial and Intermittent, Non Fish-Bearing Streams (Class 3 and 4) – 30’ NT Lakes - 60' NT Wetlands - 60'NT
<u>Unmanaged Stands</u> (Units 80-103, 841)	Fish-Bearing Streams (Class 1 and 2) - 300' NH Perennial, Non Fish-Bearing Streams (Class 3) - 150' NH Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes - 300' NH Wetlands - 150' NH	Fish-Bearing Streams (Class 1 and 2) - 300' NH Perennial, Non Fish-Bearing Streams (Class 3) – 60' NH, 50% canopy closure from 60-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes – 300' NH Wetlands – 150' NH	Fish-Bearing Streams (Class 1 and 2) – 60' NT Perennial and Intermittent, Non Fish-Bearing Streams (Class 3 and 4) – 30’ NT Lakes - 60' NT Wetlands - 60'NT

For all action alternatives, treatment within riparian reserves has been designed to comply with “Northwest Forest Plan Temperature TMDL Implementation Strategies” (USDA Forest Service and USDI BLM, 2005). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it meets the expectations of several Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

There are approximately 492 acres of riparian reserve within Bridge Thin, of which 148 acres are in the no-harvest and no-treatment buffers. The balance of 344 acres within the riparian reserve would be thinned. Table 2 summarizes general unit information, acres of riparian reserve and stream influence zone treated and the proximity of streams to listed fish habitat (LFH) / Critical Habitat (CH).

Table 2. General Unit Information and Tree Data.

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
1	14	5	4	4	No Connection	2,090	DRZ	57	11	92
2	140	62	48	48	No Connection	2,400	DRZ	57	13	82
3	47	11	11	11	No Connection	600	DRZ	57	12	81
4	57	11	9	9	No Connection	4,000	TSZ	57	13	89
5	73	18	14	14	No Connection	2,500	DRZ	57	14	91
6	87	11	7	7	No Connection	1,900	DRZ	47	14	84
7*	20	3	2	2	No Connection	1,600	DRZ	57	23	106
8	60	6	5	5	No Connection	970	DRZ	57	12	67
10	37	2	1	1	No Connection	750	DRZ	57	15	75
11	37	23	17	17	7,600	5,840	TSZ	57	12	85
12	21	14	7	7	6,900	5,050	TSZ	52	14	98
13	21	5	3	3	No Connection	5,675	TSZ	70	12	85
14	27	0	0	0	No Streams	5,000	TSZ	80	13	76
15	79	20	12	12	3,600	2,400	TSZ	57	12	82
17	24	6	4	4	No Connection	4,600	TSZ	60	14	70
18	27	3	2	2	No Connection	4,400	TSZ	57	16	73
19*	20	2	1	1	No Connection	2,700	DRZ	57	18	90
20	66	1	1	1	No Connection	1,360	DRZ	59	15	91
21	12	8	5	5	900	640	DRZ	57	14	68
23	12	2	1	1	No Connection	490	DRZ	47	15	68
24	5	0	0	0	No Streams	1,300	DRZ	59	14	79
25	26	0	0	0	No Streams	4,700	TSZ	52	12	93

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
26	14	0	0	0	No Streams	1,600	DRZ	45	16	105
27	5	0	0	0	No Streams	1,350	TSZ	87	23	97
28	7	2	1	1	No Connection	1,450	TSZ	34	11	71
29	47	2	1	1	No Connection	1,670	TSZ	59	14	76
30	38	0	0	0	No Streams	1,200	TSZ	59	13	83
31	19	0	0	0	No Streams	2,500	TSZ	61	13	90
32	123	10	8	8	No Connection	1,800	TSZ	61	18	107
33*	4	0	0	0	No Streams	3,000	TSZ	61	**	**
34	5	0	0	0	No Streams	1,800	TSZ	61	18	110
35	54	0	0	0	No Streams	740	TSZ	52	16	83
36	36	10	8	8	2,800	1,300	TSZ	42	12	75
37	43	3	3	3	No Connection	2,250	TSZ	36	10	67
38	27	0	0	0	No Streams	5,200	TSZ	36	18	112
39	20	0	0	0	No Streams	6,250	TSZ	45	12	65
40	27	13	11	11	6,200	5,600	TSZ	34	15	92
41*	7	0	0	0	No Streams	6,200	TSZ	45	**	**
42	32	0	0	0	No Streams	8,200	TSZ	49	18	105
43	44	18	11	11	10,800	8,650	TSZ	32	14	87
44	45	4	2	2	9,800	6,500	TSZ	36	13	88
45	38	12	9	9	11,000	7,700	TSZ	45	14	89
46	41	1	1	1	No Connection	8,800	TSZ	33	14	72
47	32	6	3	3	13,800	10,500	TSZ	30	12	76
48	17	1	1	1	No Connection	11,300	TSZ	32	12	69
49	7	4	3	3	No Connection	4,100	DRZ	117	14	90
50*[1]	6	5	4	4	6,500	4,200	DRZ	117	19	80
51	20	10	8	8	5,700	4,000	TSZ	36	12	84
52	11	0	0	0	No Streams	6,850	TSZ	30	12	76
53	3	0	0	0	No Streams	6,500	TSZ	35	16	106
54	10	0	0	0	No Streams	4,850	TSZ	40	13	85
55	25	2	1	1	7,700	5,850	TSZ	45	14	65
56	43	7	5	5	10,400	6,700	TSZ	65	19	120
57	15	1	1	1	No Connection	8,600	TSZ	74	24	139
58	16	0	0	0	No Streams	7,500	TSZ	41	14	67
59	22	0	0	0	No Streams	6,900	TSZ	85	15	97
60	24	8	8	8	No Connection	8,850	TSZ	41	15	69
61	16	4	4	4	No Connection	8,500	TSZ	33	13	84
62	19	0	0	0	No Streams	9,500	TSZ	52	18	94
63	29	0	0	0	No Streams	12,200	TSZ	32	13	70
64	42	9	8	8	16,000	11,300	TSZ	53	12	62
65	10	0	0	0	No Streams	12,400	TSZ	34	12	71
66	11	7	6	6	15,200	11,400	TSZ	53	18	76
67	22	2	2	2	No Connection	7,200	TSZ	48	18	100
68	41	6	6	6	No Connection	5,500	TSZ	42	16	85

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
69	33	3	3	3	4,000	3,000	TSZ	45	14	103
70	3	0	0	0	No Streams	6,900	TSZ	48	16	102
71*	3	0	0	0	No Streams	1,250	TSZ	32	**	**
72	28	5	4	4	6,900	5,000	TSZ	32	15	83
80	10	0	0	0	No Streams	1,500	TSZ	101	18	104
81	14	0	0	0	No Streams	2,600	TSZ	101	21	96
82	35	9	0	0	No Connection	2,400	TSZ	101	21	112
83	17	6	0	0	No Connection	700	TSZ	101	18	75
84	32	13	8	8	No Connection	900	TSZ	100	23	129
85	12	1	0	0	No Connection	670	TSZ	127	15	89
86*	7	4	3	3	No Connection	1,200	TSZ	87	15	**
87*[1]	2	1	0	0	No Connection	1,200	TSZ	21	**	**
88	36	13	8	8	No Connection	250	TSZ	101	21	104
89*[1]	6	1	0	0	No Connection	1,650	TSZ	87	43	143
91	38	3	0	0	No Connection	1,050	TSZ	87	19	102
95*[1]	27	12	9	9	1,280	Adjacent	DRZ	120	20	88
96*[1]	10	7	4	4	1,280	850	DRZ	120	17	65
97*[1]	5	1	0	0	No Connection	100	DRZ	95	12	70
98*[1]	4	1	1	1	No Connection	30	DRZ	95	12	61
99*[1]	13	5	3	3	2,900	1,650	DRZ	115	18	79
100*[1]	42	15	10	10	1,600	500	TSZ	92	16	100
101*[1]	12	2	1	1	No Connection	1,050	TSZ	92	18	88
102*[1]	33	15	13	13	No Connection	Adjacent	DRZ	92	22	150
103*[1]	26	11	11	11	No Connection	Adjacent	DRZ	92	20	98
841	26	4	0	0	No Connection	250	TSZ	100	23	129
TOTAL	2502	492	344	344						

* No harvest; ** No stand data; 1 Fuel treatment only (remove ladder fuels/stems <7" dbh)

2= SIZ - Stream Influence Zone, this is 1 SPT height distance from the stream

3 = Proximity is the downstream distance through connecting stream channels to listed fish distribution or CH.

4 = Dominant rain zone (DRZ), transient snow zone (TSZ), dominant snow zone (DSZ)

5 = Proximity is the overground distance to LFH/CH from the closest point of the unit.

The project will apply several different thinning prescriptions within units. These are defined as Heavy (40-55% canopy closure), Moderate (50-65% canopy closure), Wildlife (30-50% canopy closure), Oak (20-45% canopy closure), Riparian Reserve (40-55% canopy closure) and Non-commercial Fuels Thin (no change to canopy closure due to removal of ladder fuels and brush <7" dbh) (Table 3).

Table 3. Summary of project thinning and fuels treatment prescriptions.

Prescription	Target % SDImax for trees >= 7" dbh	Post Harvest % CC for trees >= 7" dbh	Residual SDI range based on DF SDImax of 595 for trees >= 7" dbh
Moderate CT (MT)	35-45	50-65	208-268
Riparian Thin(RT)	31-52 (large spread due to canopy closure requirements)	50-55 in ground based or cable units 40-50 in helicopter units to facilitate safe yarding operations	190-305 (large spread due to canopy closure requirements)
Heavy CT (HT)	17-34	40-55	101-207
Wildlife Thin (WT)	13-17	30-50	77-101
Oak Thin (OT)	17-24	20-45	101-143
Non-commericial Fuels Thin (FT)	No significant change due to removal of ladder fuels and brush less than 7" dbh		

Units with <200 TPA >= 7" dbh were assigned the Moderate CT Rx.

Units with >=200 TPA >= 7" dbh were prescribed Heavy CT.

Wildlife Thin units are those units with an emphasis of creating elk habitat.

Riparian Thin is a subset of the original unit (HT, OT, WT) with requirements for canopy closure Rx and are tracked independently in this analysis.

Oak Thin units are those units with an emphasis on restoring Oak Savanna habitat.

Fuels Thin units are units where no commercial thin would occur where fuels reduction in the Wildland Urban Interface is planned.

Table 4 summarizes pre and post treatment stand conditions in each unit and within the stream influence zone.

Table 4. Unit Harvest Treatment Information.

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	86	53	86	53	392	106	392	106	78	18	78	18	260	56	260	56
2	74	40	74	50	252	171	252	171	62	24	62	24	219	84	219	84
3	73	50	73	50	268	207	268	207	64	27	64	27	224	92	224	94
4	63	40	63	50	184	144	184	144	49	24	49	24	177	89	177	89
5	71	40	71	50	202	109	202	109	59	25	59	25	220	94	220	94
6	76	41	76	50	213	138	213	138	60	22	60	22	222	83	222	83
7*	52	52	52	52	68	68	68	68	41	41	41	41	200	200	200	200
8	69	43	69	50	223	179	223	179	51	26	51	26	179	90	179	90
10	55	41	55	50	138	140	138	140	44	30	44	30	173	120	173	120
11	68	50	68	50	206	157	206	157	48	29	48	29	168	102	168	102
12	70	56	70	56	181	156	181	156	53	36	53	36	200	136	200	136
13	81	45	81	50	260	194	260	210	58	24	58	27	200	86	200	96
14	79	43	No Streams	No Streams	274	171	No Streams	No Streams	70	29	No Streams	No Streams	250	113	No Streams	No Streams
15	74	40	74	50	278	176	278	215	67	26	67	35	236	91	236	123
17	59	40	59	50	171	181	171	214	47	27	47	36	173	99	173	133
18	61	41	61	50	137	89	137	117	47	28	47	36	188	115	188	147
19*	14	14	14	14	22	22	22	22	9	9	9	9	40	40	40	40

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
20	64	50	64	50	170	269	170	269	55	37	55	37	213	144	213	144
21	61	53	61	53	157	152	157	152	43	35	43	35	160	129	160	129
23	71	58	71	58	189	169	189	169	58	40	58	40	224	158	224	158
24	64	52	No Streams	No Streams	319	161	No Streams	No Streams	44	35	No Streams	No Streams	166	130	No Streams	No Streams
25	80	40	No Streams	No Streams	296	227	No Streams	No Streams	69	22	No Streams	No Streams	240	76	No Streams	No Streams
26	65	53	No Streams	No Streams	161	115	No Streams	No Streams	55	34	No Streams	No Streams	220	131	No Streams	No Streams
27	48	40	No Streams	No Streams	63	295	No Streams	No Streams	39	27	No Streams	No Streams	187	131	No Streams	No Streams
28	92	40	92	50	591	120	591	120	115	23	115	23	380	77	380	77
29	65	42	65	50	195	130	195	130	56	29	56	29	203	108	203	108
30	69	43	No Streams	No Streams	296	137	No Streams	No Streams	72	28	No Streams	No Streams	253	94	No Streams	No Streams
31	60	40	No Streams	No Streams	208	114	No Streams	No Streams	51	28	No Streams	No Streams	180	99	No Streams	No Streams
32	63	51	63	51	133	103	133	103	57	41	57	41	243	176	243	176
33*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
34	64	50	No Streams	No Streams	133	89	No Streams	No Streams	60	40	No Streams	No Streams	260	176	No Streams	No Streams
35	68	40	No Streams	No Streams	247	116	No Streams	No Streams	61	27	No Streams	No Streams	216	96	No Streams	No Streams
36	74	40	74	50	324	135	324	135	69	26	69	26	236	89	236	89
37	73	40	73	50	331	172	331	172	60	24	60	24	195	77	195	77
38	61	40	No Streams	No Streams	115	116	No Streams	No Streams	47	25	No Streams	No Streams	198	107	No Streams	No Streams
39	72	40	No Streams	No Streams	277	115	No Streams	No Streams	65	26	No Streams	No Streams	232	91	No Streams	No Streams
40	75	31	75	51	197	90	197	90	64	17	64	17	250	66	250	66
41*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
42	48	30	No Streams	No Streams	69	62	No Streams	No Streams	30	16	No Streams	No Streams	127	69	No Streams	No Streams
43	76	30	76	51	245	111	245	111	72	18	72	18	270	68	270	68
44	76	31	76	51	287	76	287	76	70	19	70	19	250	66	250	66
45	66	30	66	50	194	105	194	105	54	18	54	18	202	68	202	68
46	57	31	57	50	115	137	115	137	32	15	32	15	120	54	120	54
47	81	43	81	50	334	474	334	474	73	24	73	24	250	83	250	83
48	77	52	77	52	288	223	288	223	68	33	68	33	240	111	240	111
49	71	47	71	50	219	307	219	307	64	27	64	27	240	99	240	99
50*1	48	48	48	48	94	94	94	94	42	42	42	42	180	180	180	180
51	90	44	90	50	339	385	339	385	80	20	80	20	280	71	280	71
52	73	40	No Streams	No Streams	243	513	No Streams	No Streams	57	22	No Streams	No Streams	198	78	No Streams	No Streams
53	52	40	No Streams	No Streams	96	65	No Streams	No Streams	35	23	No Streams	No Streams	140	95	No Streams	No Streams

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
54	80	45	No Streams	No Streams	290	572	No Streams	No Streams	71	24	No Streams	No Streams	253	83	No Streams	No Streams
55	77	40	77	50	266	94	266	94	78	27	78	27	294	103	294	103
56	72	40	72	50	176	205	176	205	78	31	78	31	335	133	335	133
57	67	40	67	50	102	123	102	123	66	31	66	31	325	152	325	152
58	65	52	No Streams	No Streams	168	118	No Streams	No Streams	50	34	No Streams	No Streams	191	130	No Streams	No Streams
59	76	40	No Streams	No Streams	263	537	No Streams	No Streams	86	31	No Streams	No Streams	338	120	No Streams	No Streams
60	62	50	62	50	147	140	147	140	48	35	48	35	190	138	190	138
61	78	40	78	50	248	271	248	271	66	22	66	22	240	81	240	81
62	56	50	No Streams	No Streams	106	107	No Streams	No Streams	46	38	No Streams	No Streams	196	162	No Streams	No Streams
63	78	41	No Streams	No Streams	259	274	No Streams	No Streams	66	23	No Streams	No Streams	240	84	No Streams	No Streams
64	74	56	74	56	287	200	287	200	65	39	65	39	227	135	227	135
65	81	55	No Streams	No Streams	299	268	No Streams	No Streams	65	31	No Streams	No Streams	220	106	No Streams	No Streams
66	63	50	63	50	138	109	138	109	57	39	57	39	242	167	242	167
67	66	51	66	51	111	223	111	223	47	31	47	31	198	132	198	132
68	51	32	51	50	91	251	91	251	30	15	30	15	120	59	120	59
69	71	41	71	50	233	90	233	90	67	25	67	25	253	95	253	95
70	49	43	No Streams	No Streams	97	211	No Streams	No Streams	33	27	No Streams	No Streams	133	109	No Streams	No Streams
71*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
72	48	40	48	48	97	77	97	77	32	25	32	25	124	97	124	97
80	68	20	No Streams	No Streams	182	35	No Streams	No Streams	76	15	No Streams	No Streams	320	62	No Streams	No Streams
81	66	49	No Streams	No Streams	114	72	No Streams	No Streams	61	34	No Streams	No Streams	280	149	No Streams	No Streams
82	56	40	56	50	109	63	109	63	56	38	56	38	256	180	256	180
83	62	40	62	50	132	561	132	561	54	31	54	31	227	138	227	138
84	54	26	54	50	92	34	92	34	55	22	55	22	260	108	260	108
85	46	42	46	46	67	58	67	58	21	18	21	18	80	67	80	67
86*	6	6	6	6	8	8	8	8	3	3	3	3	10	10	10	10
87[*1]	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
88	61	40	61	51	116	54	116	54	63	35	63	35	290	169	290	169
89[*1]	36	36	36	50	20	20	20	20	31	31	31	31	200	200	200	200
91	46	41	46	50	71	59	71	59	32	26	32	26	140	112	140	112
95[*1]	53	53	53	53	67	265	67	265	32	32	32	32	145	145	145	145
96[*1]	55	55	55	55	93	421	93	421	34	34	34	34	140	140	140	140
97[*1]	59	59	59	59	149	391	149	391	34	34	34	34	120	120	120	120
98[*1]	89	89	89	89	330	532	330	532	79	79	79	79	280	280	280	280
99[*1]	83	83	83	83	133	380	133	380	56	56	56	56	240	240	240	240
100[*1]	62	62	62	62	149	168	149	168	54	54	54	54	220	220	220	220
101[*1]	54	54	54	54	114	114	114	114	47	47	47	47	200	200	200	200
102[*1]	50	50	50	50	92	107	92	107	53	53	53	53	250	250	250	250

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
103*[1]	42	42	42	42	84	84	84	84	42	42	42	42	187	187	187	187
841	54	40	54	50	92	59	92	59	55	36	55	36	260	175	260	175

* No harvest; ** No stand data; [1] Fuel treatment only (remove ladder fuels/stems <7" dbh)

2) Timber Yarding

Yarding systems for this project include ground-based, skyline and helicopter methods. Harvesting methods will be based on the topography of the land and the correlation to the existing road system and in some cases more then one harvesting method may be used per unit. Units with portions less than 30% in slope and stable soils are suitable for ground-based harvest. Ground-based machinery may be used to harvest logs from existing roads where the equipment can reach the logs without having to leave the road system. Table 5 shows acres of harvest method per unit and skyline corridor information. Figures A-4 and A-5 in Appendix A show logging systems for all units.

Table 5. Yarding and Skyline Corridor Information

Unit	Acres by Yarding System[2]			Skyline Corridors Across Streams			
				Perennial		Intermittent	
	Ground	Skyline	Helicopter	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
1	0	0	13				
2	103	14	9	0	N/A	2	No Connection
3	47	0	0				
4	18	0	37				
5	52	0	17				
6	21	46	16	0	N/A	0	N/A
7*	0	0	0				
8	59	0	0				
10	36	0	0				
11	0	31	0	10	7,600	10	tributary to perennial stream
12	0	14	0	11	6,900	3	tributary to perennial stream
13	0	0	19				
14	0	0	27				
15	0	0	71				
17	0	0	22				
18	0	0	26				
19*	0	0	0				
20	66	0	0				
21	10	0	0				
23	11	0	0				
24	5	0	0				
25	0	26	0	0	N/A	0	N/A
26	11	0	3				
27	0	5	0	0	N/A	0	N/A
28	4	2	0	0	N/A	0	N/A

Unit	Acres by Yarding System[2]			Skyline Corridors Across Streams			
				Perennial		Intermittent	
	Ground	Skyline	Helicopter	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
29	6	0	40				
30	9	0	29				
31	0	1	18	0	N/A	0	N/A
32	0	121	0	0	N/A	0	N/A
33*	0	0	0				
34	0	5	0	0	N/A	0	N/A
35	6	48	0	0	N/A	0	N/A
36	0	34	0	0	N/A	6	2,800
37	0	43	0	0	N/A	0	N/A
38	0	27	0	0	N/A	0	N/A
39	2	20	0	0	N/A	0	N/A
40	20	5	0	9	6,200	0	N/A
41*	0	0	0				
42	0	32	0	0	N/A	0	N/A
43	33	4	0	0	N/A	0	N/A
44	43	0	0				
45	15	20	0	10	11,000	4	tributary to perennial stream
N/A 46	5	36	0	0	N/A	0	N/A
47	0	29	0	7	13,800	0	N/A
48	17	0	0				
49	6	0	0				
50*[1]	0	0	0				
51	0	18	0	2	5,600	6	tributary to perennial stream
52	0	11	0	0	N/A	0	N/A
53	0	3	0	0	N/A	0	N/A
54	10	0	0				
55	0	24	0	0	N/A	0	N/A
56	0	0	41				
57	0	0	15				
58	0	16	0	0	N/A	0	N/A
59	0	22	0	0	N/A	0	N/A
60	10	14	0	0	N/A	0	N/A
61	16	0	0				
62	19	0	0				
63	0	14	15	0	N/A	0	N/A
64	6	35	0	0	N/A	0	N/A
65	0	10	0	0	N/A	0	N/A
66	9	1	0	0	N/A	0	N/A
67	22	0	0				
68	10	31	0	0	N/A	0	N/A
69	15	18	0	0	N/A	0	N/A
70	0	3	0	0	N/A	0	N/A
71*	0	0	0				
72	8	19	0	0	N/A	0	N/A
80	0	10	0	0	N/A	0	N/A
81	0	14	0	0	N/A	0	N/A
82	0	26	0	6	No	0	N/A

Unit	Acres by Yarding System[2]			Skyline Corridors Across Streams			
				Perennial		Intermittent	
	Ground	Skyline	Helicopter	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
					Connection		
83	0	11	0	0	N/A	0	N/A
84	0	20	7	0	N/A	3	No Connection
85	0	0	11				
86*	0	0	0				
87*[1]	0	0	0				
88	0	8	23	0	N/A	4	No Connection
89*[1]	0	0	0				
91	17	18	0	2	No Connection	0	N/A
95*[1]	0	0	0				
96*[1]	0	0	0				
97*[1]	0	0	0				
98*[1]	0	0	0				
99*[1]	0	0	0				
100*[1]	0	0	0				
101*[1]	0	0	0				
102*[1]	0	0	0				
103*[1]	0	0	0				
841	0	22	0	0	N/A	0	N/A
TOTAL	747	931	459	57		38	

* No harvest; ** No stand data; [1] Fuel treatment only (remove ladder fuels/stems <7" dbh)

[2] Acres by yarding system excludes acres not treated due to riparian buffers. Therefore, these acres will vary from Total Acres in Table 2.

Note: Shaded rows indicate units with skyline yarding.

<u>Ground-Based Yarding</u>

Approximately 747 acres will be harvested via ground-based methods – 35 percent of the harvest area. Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms to avoid accumulation and transport of overland flow of sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system would be used wherever possible. Minimization of new riparian reserve disturbance will occur with designation of skid trails. Restrictions in equipment proximity to channels are described in Table 13.

<u>Skyline Yarding</u>

Skyline yarding would occur on terrain with sufficient slope to allow at least one end of the log to be suspended above the ground. As a result, these methods would be focused on those areas adjacent to streams, positioned on midslope terrain areas, or on higher slopes possessing adequate access to existing roads. These conditions occur on slopes ranging from 30 to 70 percent within the action area. Skyline yarding would occur on approximately 931 acres - 44 percent of the harvest area. Cut logs would be hauled by cable upslope, and downslope, to landing locations attached to the existing road system. A minimum of one end of the tree would be suspended above the ground, and full suspension would be utilized wherever topography permitted. Yarding corridors would be spaced at least 100 feet apart to reduce additive effects. Full suspension will be required over all perennial waterways. Where full suspension is not possible over intermittent streams, yarding over dry channels only will be required. Skyline yarding equipment would not be permitted within the no-harvest corridors adjacent to all streams. Approximately 57 skyline corridors are proposed across perennial streams and 38 across intermittent streams, all of which are more then 0.5 mile away from LFH (Table 5).

No seasonal restrictions would apply to skyline cable yarding operations, however, skyline cable yarding systems will operate only when landing conditions are relatively dry. Operations will be suspended if rainfall or precipitation results in pooling of water in landings. See Table 13 for more project mitigations, best management practices and design criteria.

Helicopter Yarding

Helicopter yarding would be utilized on approximately 459 acres – 21 percent of the harvest area. Areas planned for helicopter yarding include all of the harvested acres at risk of soil disturbance due to the slope of the ground. Helicopter yarding will also be used where access to system roads is limited. Helicopter operations would not occur in some units between March 1 to July 15 to protect spotted owls during their breeding season. Helicopter yarding would provide full suspension. There is no other seasonal or conditional restriction on helicopter yarding.

Riparian Reserve Harvest Methods

A total of 344 acres within riparian reserves will be treated outside of the designated no-harvest and no-fuels-treatment buffers. Approximately 282 acres will be treated with harvest methods (not fire hazard reduction). A significant portion of riparian reserve thinning (46%) is accomplished with ground-based harvest. Ground-based yarding equipment (and fuels reduction equipment) would not be permitted within 120 feet of the stream channel of fish-bearing and perennial non fish-bearing (Class 1, 2, and 3) streams. Ground-based equipment would not be permitted within 50 feet of the stream channel in intermittent, non fish-bearing (Class IV) streams. In the remainder of the riparian reserve, ground-based equipment is permitted, but would be restricted to existing skid trails from previous entries. Alternative low disturbance ground-based equipment, such as shovel yarding, is also permitted in the remainder of the riparian reserve. About 36 percent of riparian reserve thinning is accomplished by skyline suspension, with a minimum of partial suspension. Full suspension is required over perennial channels. Where full suspension is not possible over intermittent channels, partial suspension over dry channels is required. Corridors over stream channels are necessary for thinning operations in some units (Table 5). Mitigations to maintain the benefits of woody material in channel and streambank stability will require trees fallen in no-harvest buffers for a corridor to be left in-stream (Table 13) and full suspension of yarded material. Approximately 18 percent of riparian reserve thinning will be accomplished by helicopter with full suspension.

3) Timber and Rock Hauling

Approximately 36 miles of road are proposed for timber and rock haul (Figures A-6, A-7). Two miles of haul road is asphalt paved and selected for wet weather haul. Approximately 27 miles are aggregate surface road, 21.5 miles of which is selected for wet weather haul. About 4 miles are native surface road restricted from wet weather haul. Table 6 summarizes the haul route information and proximity to LFH.

The primary route for timber hauling from federal land on the west side of the project area is FS Road 1900-408 – Langasher Road. A 0.6-mile section of this road will not be hauled on. Instead, haul from adjacent units will be directed east and west of the non-haul section. FS Road 1900-408 is the only aggregate surface road in the west side of the project area selected for wet weather haul. In this area, there are three stream crossings over LFH - two paved bridges over the McKenzie River and one paved bridge over the South Fork McKenzie River. There is only one other stream crossing in the west side haul route that has surface connection to LFH, approximately 1,400 feet downstream. It is an intermittent, non fish-bearing stream located in the South Fork McKenzie/Cougar Creek 6th Field subwatershed (See Action Area Description and Table 12 for details). In the east side of the project area, the two main roads used for timber hauling are FS Roads 2633 and 1501, both aggregate surfaced roads. There are no stream crossings in this area over LFH. All wet weather haul routes have aggregate surface and will receive road upgrades such as the addition of surface aggregate and additional cross drain culverts before use. Winter haul will be immediately stopped if the timber sale administrator finds sign of road surface deformation leading to sediment eroding into live streams. See Table 13 for project mitigation, BMPs and design criteria related to timber hauling.

The Mill Creek rock pit is located in Unit 41 on FS Road 2633-720. Approximately 1,000 loads (approximately 15,000 cubic yards) of rock will be hauled out of this location – about 75% down FS Road 2633 and 25% up FS Road 2366 and down FS Road 1501 – to various locations throughout the project area selected for road reconstruction and maintenance.

Table 6. Aggregate and Native-surface Haul Route Information

Haul Route by road #	Season of Use[1]	Miles of Haul	Road Surface (A,N)	# of Loads	Number of Crossings Over:				Nearest Distance (ft) from Crossing To LFH by Type:		Road Length Within 100' of LFH/CH[2]
					LFH		Other Peren.	Other Inter.	Peren.	Inter.	
					Bridge	Culvert					
1500-100	DS	0.2	A	168	0	0	0	0			0
1500-101	DS	0.5	A	135	0	0	0	0			0
1500-104	DS	3.0	A	864	0	0	1	1	No Connection	No Connection	0
1500-105	DS	0.5	A	864	0	0	0	0			0
1501	YR	3.6	A	2,658	0	0	2	2	13,400	(1) 4200; (1) No Connection	0
1501-060	DS	0.1	N	2	0	0	0	0			0
1501-075	DS	0.1	A	2	0	0	0	0			0
1501-198	DS	0.4	A	208	0	0	0	0			0
1501-202	DS	0.4	A	77	0	0	0	0			0
1900-386	DS	0.1	N	0	0	0	0	0			0
1900-387	DS	0.4	N	22	0	0	0	0			0
1900-393	DS	0.2	N	0	0	0	0	1		No Connection	0
1900-394	DS	0.2	N	212	0	0	0	2		No Connection	0
1900-396	DS	0.1	N	86	0	0	0	0			0
1900-398	DS	0.1	N	0	0	0	0	0			0
1900-401	YR/DS[3]	2.8	A	946	0	0	2	4	(2) No Connection	(1) No Connection; (3) 9,000	0
1900-402	DS	0.5	N	688	0	0	0	1		No Connection	0
1900- 408 West	YR	4.1	A	2,119	0	0	1	2	No Connection	(1) No Connection; (1) 1,400	0
1900- 408 East	YR	2.6	A	925	0	0	0	0			0
2633	YR	5.5	A	5,845	0	0	4	2	(1) 7,400; (1) 8,000; (1) 13,900; (1) 13,600	(1) 13,900; (1) 17,000	0
2633-620	DS	0.1	N	14	0	0	0	0			0

Haul Route by road #	Season of Use[1]	Miles of Haul	Road Surface (A,N)	# of Loads	Number of Crossings Over:				Nearest Distance (ft) from Crossing To LFH by Type:		Road Length Within 100' of LFH/CH[2]
					LFH		Other Peren.	Other Inter.	Peren.	Inter.	
					Bridge	Culvert					
2633-700	YR	1.0	A	1,844	0	0	0	2		(1) 6,800; (1) No Connection	0
2633-701	DS	1.0	A	784	0	0	0	1		No Connection	0
2633-702	DS	1.0	A	784	0	0	0	1		10,200	0
2633-714	YR	0.4	N	218	0	0	0	1		7,000	0
2633-715	DS	0.1	N	17	0	0	0	0			0
2633-720	DS	2.1	A	691	0	0	7	0	(2) 9,700; (2) 8,800; (1) 9,800; (1) 10,700; (1) 11,300		0
2633-722	DS	0.2	N	123	0	0	0	0			0
2633-723	DS	0.6	A	326	0	0	1	0	10,900		0
2633-725	DS	0.4	A	86	0	0	0	0			0
2633-740	DS	1.1	A	158	0	0	0	0			0
2633-745	DS	0.2	N	207	0	0	1	0	11,700		0
2633-760	DS	0.5	N	127	0	0	0	1		15,000	0
2633-763	DS	0.1	N	2	0	0	0	2		15,200	0
2633-765	DS	0.3	N	73	0	0	0	2		(1) 15,800; (1) 16,000	0
2633-768	DS	0.2	N	51	0	0	0	3		(2) 15,700; (1) 16,000	0
2633-770	DS	0.1	N	89	0	0	0	0			0
2633-784	DS	0.0	A	0	0	0	0	0			0
2633-789	DS	0.8	N	150	0	0	0	0			0
TOTAL		35.7		13,900	0	0	19	28			0

[1] Season of use: dry season only, year-round

[2] Road length within 100' of LFH is a measure of "drawbottom" roads used by haul route, does not include distance at c crossings, which is already accounted for in the previous columns.

[3] See haul route map in Appendix A for seasonal split

[4] Based on 4,000 BF per load

4) Road, Rock Pit and Landing Work

This project element consists of five sub-elements: 1) stream culvert replacement, 2) road construction, reconstruction, decommissioning and closure, 3) road maintenance, 4) landing construction and (5) rock pit development.

1) *Stream Culvert Replacement:*

Eight perennial stream culverts and 18 intermittent stream culverts – 26 total – are proposed for replacement or installation (Table 7). Four intermittent stream culverts are within 0.5 miles of LFH, but have no surface connection to LFH. The closest stream crossing – an intermittent stream – to LFH with surface connection is 1.0 mile. Three culverts are upstream of Tokatee Golf Course and are tributary to a series of ponds and wetlands. All perennial stream crossings are greater than one mile from LFH. In order to reduce the amount of sediment entering the live streams, culverts would be replaced during the ODFW in-stream work period for the watershed (July 15 through October 15), the dry season, and a de-watering plan would be implemented on all perennial streams scheduled for culvert replacement. Erosion control measures such as spreading straw, seeding, hay bales, silt fences or other means deemed effective for individual sites would be used when there is potential for off-site delivery of sediment to the streams (Table 13). Culvert sizing and design will accommodate Q100 flow.

Table 7. Stream Culvert Installation, Replacement or Decommissioning

Road Number	New Culvert Diameter	Streamflow	Install/ Replace/ Decommission	Height of Fill to be Removed	Distance to LFH/CH
	Inches	Class	I/R/D	Feet	Feet
1900- 401	24	I	R	5	2,640*
	36	I	R	6	3,168*
	24	I	R	5	6,864*
	24	I	R	5	3,168*
	24	I	R	5	3,696*
	24	I	R	5	5,280
1900- 393	24	I	I	5	1,584*
	24	I	I	5	2,112*
1900- 384	60	I	R	10	2,640*
2633	24	P	R	5	6,864
	24	I	R	5	6,864
2633- 620	24	I	I	5	6,336**
	24	I	I	5	6,336**
	36	P	I	6	5,808**
2633- 720	60	P	R	8	8,448
	36	P	R	6	8,448
	24	I	R	15	8,448
	24	I	R	5	9,504
	36	P	R	6	10,560
	24	P	R	15	11,088
	24	P	R	5	12,672
	24	P	R	5	12,144
2633- 760	24	I	R	5	14,784
	24	I	R	5	15,840
2633- 765	24	I	I	5	15,840
	24	I	R	5	16,368
2633- 723	NA	P	D	5	10,560
2633- 763	NA	I	D	5	14,256
2633- 764	NA	I	D	5	14,784

* culvert replacement in channels with no surface connection to the McKenzie River;

**culvert replacements upstream of Tokatee Golf Course and are tributary to a series of golf course ponds

LFH = Listed Fish Habitat/Critical Habitat (McKenzie River, South Fork McKenzie River).

(2) *Road Construction, Reconstruction, Decommissioning and Closure:*

Approximately 4.8 miles of semi-permanent spur road construction would occur within the action area (Table 8). Road construction will occur from existing system roads located on stable flat ground. Spur road construction would occur outside of riparian reserves where logging systems permit, with exception to one new spur road built over two existing intermittent streams in Unit 2 (Figure A-8). Intermittent streams through Unit 2 provide no surface connection to LFH. Temporary culverts will be installed and will be removed if activities halt for the wet season. All spur roads will be stabilized with erosion control measures as necessary for the wet season (i.e. waterbars, etc.) to minimize accumulation of runoff and transport of sediment. Semi-permanent roads (and temporary culverts) will be fully decommissioned after the project is complete. Proper drainage will be installed and maintained throughout the operating season. No other road construction will occur.

Approximately 31 miles of permanent road reconstruction will occur within the action area. Reconstruction activities may include cutting roadside brush and/or trees, grubbing tree and brush roots, constructing or reconstructing ditches, replacing or installing culverts, raising road grade by utilizing borrow materials, constructing rolling dips or waterbars, shifting road alignment, placement of aggregate surfacing, constructing or reconstructing turnouts or turnarounds. Approximately 8.3 miles of reconstruction occur within 0.5 miles of LFH (Table 10). These roads have 5 stream crossings within 0.5 mile of LFH – 4 with no surface connection and one within 1,400 feet of surface connection to LFH. The existing road and culvert at this stream crossing is in good condition and little reconstruction is needed.

Approximately 0.3 miles of existing permanent road will be decommissioned (Figure A-9) and 0.5 will be closed. Decommissioning includes obliteration and elimination of existing road, including necessary cleanup work, and in this case removing three stream crossing structures and restoring channel topography. All culverts would be removed, fills would be pulled back, and the road would be sub-soiled. (See Figures A-9, A-10a and A-10b for maps of proposed decommissioning and closure). Road closure will convert the road into a storage condition by restricting access and restoring hydrologic stability.

Table 8. New Road Construction/ Reconstruction and Road Decommissioning

Surface-Type	Miles of New Road Construction			Miles of Road Reconstruction	Miles of Pre-existing Road Decommissioned	Miles of Pre-existing Road Closed
	Permanent[1]	Semi-permanent[2]	Temporary[3]			
Natural	0	4.8	0.0	4.2	0.3	0.5
Aggregate	0	0.0	0.0	26.8	0.0	0.0
Paved	0	0.0	0.0	0.0	0.0	0.0
Total Miles	0	4.8	0.0	31.0	0.3	0.5

[1] Permanent – road will remain available for use after the sale ends

[2] Semi-permanent – road will be decommissioned at the end of the sale

[3] Temporary – road will be built and decommissioned within the same dry season

Construction – builds new road; Reconstruction – improves existing unusable road to new road standards

(3) *Road Maintenance*

Approximately 2.0 miles of road maintenance will occur within the action area (Table 9). Road maintenance activities may include cutting hardwood trees along roads, felling hazard trees for the life of the road, clearing and grubbing, surface blading, replacing drainage structures, reshaping ditches, and placement of aggregate surfacing. Approximately 0.2 miles of maintenance will occur within 0.5 miles of LFH, but no stream crossings exist (Table 10).

1 **Table 9. Road Maintenance/Renovation**

Road number	Surface Type	Reconstruction Miles	Maintenance Miles	Number of Stream Crossings (perennial and intermittent)	Distance to LFH/CH from Nearest Crossing (feet)
1500-100	A		0.2	0	
1500-101	A	0.5		0	
1500-104	A	3.0		2	(2) No Connection
1500-105	A	0.5		0	
1501	A	3.6		2	(2) 13,400
1501-060	N	0.1		0	
1501-075	A		0.1	0	
1501-198	A	0.3		0	
1501-202	A	0.4		0	
1900-386	N		0.1	0	
1900-387	N	0.4		0	
1900-393	N	0.2		0	
1900-394	N		0.2	0	
1900-396	N	0.1		0	
1900-398	N		0.1	0	
1900-401	A	2.8		6	(3) No Connection; (3) 9,000
1900-402	N	0.5		1	No Connection
1900-408	A/N	4.1		3	(2) No Connection; (3) 1,400
2633	A	5.5		6	(1) 7,400; (1) 8,000; (1) 13,600; (2) 13,900; (1) 17,000
2633-620	N		0.1	0	
2633-700	A	1.0		2	(1) No Connection; (1) 6,800
2633-701	A	1.0		1	No Connection
2633-702	A	1.0		1	10,200
2633-714	N	0.4		1	7,000
2633-715	N	0.1		0	
2633-720	A	2.1		7	(2) 9,700; (2) 8,800; (1) 9,800; (1) 10,700; (1) 11,300
2633-722	N	0.2		0	
2633-723	A	0.6		1	10,900
2633-725	A	0.4		0	
2633-740	A		1.1	0	
2633-745	N	0.2		1	11,700
2633-760	N	0.5		1	15,000
2633-763	N	0.1		2	(2) 15,200
2633-765	N	0.3		2	(1) 15,800; (1) 16,000
2633-768	N	0.2		3	(2) 15,700; (1) 16,000
2633-770	N		0.1	0	
2633-784	A		0.0	0	
2633-789	N	0.8		0	
	TOTAL	31.0	2.0	41	

Table 10. Road Reconstruction and Maintenance within 0.5 Miles of LFH

Road Number	Surface Type	Within 0.5 Mile of LFH			Distance to LFH/CH from Stream Crossing (feet)
		Miles of Reconstruction	Miles of Maintenance	Number of Stream Crossings (perennial and intermittent)	
1500-100	A	0.0	0.2	0	
1500-101	A	0.3	0.0	0	
1500-104	A	1.5	0.0	2	(2) No Connection
1500-105	A	0.2	0.0	0	
1501	A	1.1	0.0	0	
1501-060	N	0.1	0.0	0	
1900-393	N	0.1	0.0	0	
1900-401	A	0.6	0.0	1	No Connection
1900-408	A	4.1	0.0	2	(1) No Connection; (1) 1,400
2633	A	0.2	0.0	0	
Total		8.3	0.2	5	

4) *Landing Construction*

There are 7 new helicopter landings and no new skyline landings proposed for this project. All new landing construction will occur outside of riparian reserves. Landings are no closer than 600 feet from LFH and have no hydrological connection to stream channels (see Figures A-4 and A-5 in Appendix A for landing locations). Typical landing locations occur on the existing road system and will require minor maintenance and rebuilding to become functional.

5) *Rock Pit Development*

Rock Pit development will take place in the existing Mill Creek rock pit located on FS Road 2633-720. It is currently 4 acres and there will be 0.5 acres of new development. Approximately 15,000 cubic yards of material will be extracted to use for road reconstruction and maintenance activities. No timber will be removed for new development. The nearest perennial streams are over 1,000 feet away. Mill Creek rock pit is located 1.6 miles from LFH.

5) Fuels Treatment

This project element consists of three sub-elements: 1) Post-Commercial-Thinning Fuels Treatment, (2) Fire Hazard Reduction (No Commercial Timber Harvest) and (3) Natural Fuels Underburn:

(1) *Post Commercial Thinning Fuels Treatment (Units 1-6, 8-18, 20-32, 34-40, 42-49, 51-70, 72-85, 88, 91, 841)*

Post commercial thinning fuels will be reduced by several treatment prescriptions. Where possible, the project will maximize the use of a processor or similar equipment to concentrate fuels within units. Additional machine/grapple piling and burning will occur on approximately 480 to 622 acres within thinning units. Hand piling will occur on approximately 312 to 792 acres, and mulching with a machine may occur on up to 124 acres (Table 11). All equipment is restricted 120 feet from perennial streams and 50 feet from intermittent streams. There will be a 60-foot no-treatment buffer on fish-bearing streams and a 30-foot buffer on non fish-bearing streams (Table 1). Pile burning will likely occur in the winter, in rainy or high humidity conditions. Mulching will occur from Spring to Fall.

Prescribed underburns will occur on approximately 879 acres and may occur on up to 1,514 acres, depending on tree size within each unit. Fire line will be constructed around the unit boundary. No-treatment buffers (Table 1) will be in place for underburns. However, fire line will not be constructed within the riparian reserve, so fire will be allowed to back down into the buffer. Burning will occur in spring-like conditions with high moisture content in the larger fuels >3". Water resources will be used to prevent burning outside of the unit boundary. Water used for treatment will be drafted from various water sources outside of Listed Fish Habitat (see Figure A-11 for potential sites). Water is drafted out of the stream channel by a pump and into a fire engine that has a holding capacity of 1,000 gallons. Water is then transported, used on the work site, or dumped into folding tanks at the work site location. At all drafting locations, 90% of stream flow will be maintained to reduce risk to aquatic species and water quality.

(2) Fire Hazard Reduction (No Commercial Timber Harvest) (Units 50, 86, 87, 89, 95-103)

Fire hazard reduction treatment consists of removing trees and stems <7” dbh through mechanical means. These small stems will be grapple piled and burned and/or mulched to reduce fuels. This treatment may occur on up to 142 acres. All restrictions, no-treatment buffers, and design criteria listed above in *Post Commercial Thinning Fuels Treatment* will apply. Exceptions to fuels treatment within the unit boundaries will occur in Units 95, 97, 98, 102 and 103 where paved roads parallel the McKenzie River (Figure A-14). Instead of treating down to the 60 foot no-treatment buffer, fuels treatment will stop at the road, leaving larger buffers approximately 100 feet in width.

(3) *Natural Fuels Underburn (Unit 100)*

Natural Fuels underburn may occur on up to 42 acres in Unit 100. Fire line would be constructed around the unit boundary. The underburn would exclude commercial thinning, and not exceed 20% fire mortality. No-treatment buffers will be in place and no fire line would be constructed within riparian reserves, so fire may back down into buffers. Water resources will be used to prevent burning outside of the unit boundary. Burning will occur in spring-like conditions with high moisture content. Water used for treatment will be drafted from nearby water sources outside of Listed Fish Habitat (Figure A-11) and 90% of stream flow will be maintained.

Table 11. Fuels Treatment Prescriptions.

UNIT	ACRES	FUELS TREATMENT
1	14	HP
2	140	GP/HP
3	47	GP/HP
4	57	HP
5	73	UB*/GP/HP
6	87	UB*/GP/HP
7*	20	NT
8	60	GP/HP
10	37	UB
11	37	GP/HP
12	21	GP/HP
13	21	HP
14	27	HP
15	79	HP
17	24	HP
18	27	UB
19*	20	NT
20	66	UB
21	12	GP/HP
23	12	GP/HP
24	5	GP/HP
25	26	GPHP
26	14	UB
27	5	UB
28	7	GP/HP
29	47	UB*/GP/HP
30	38	GP/HP
31	19	UB*/HP
32	123	UB
33*	4	NT
34	5	UB
UNIT	ACRES	FUELS TREATMENT
35	54	UB
36	36	UB*/HP
37	43	UB*/HP
38	27	UB
39	20	UB*/GP/HP
40	27	UB
41*	7	NT
42	32	UB
43	44	UB*/GP/HP
44	45	UB*/GP/HP
45	38	UB*/GP/HP
46	41	UB*/GP/HP
47	32	HP
48	17	GP/HP
49	7	GP
50*	6	FT/GP or Mulch
51	20	HP
52	11	UB*/HP
53	3	UB
54	10	GP/HP
55	25	UB*/HP
56	43	UB
57	15	UB
58	16	UB*/HP
59	22	UB
60	24	UB
61	16	UB*/GP/HP
62	19	UB
63	29	HP
64	42	GP/HP
65	10	HP
UNIT	ACRES	FUELS TREATMENT
66	11	UB
67	22	UB
68	41	UB
69	33	UB*/GP/HP
70	3	UB
71*	3	NT
72	28	UB
80	10	UB
81	14	UB
82	35	UB
83	17	UB
84	32	UB
85	12	UB
86*	7	UB
87*	2	UB
88	36	UB
89*	6	FT/ HP
91	38	UB
95*	27	FT/GP or Mulch
96*	10	FT/GP or Mulch
97*	5	FT/GP or Mulch
98*	4	FT/GP or Mulch
99*	13	FT/GP or Mulch
100*	42	Natural Fuels UB or FT
101*	12	FT/GP or Mulch
102*	33	FT/GP or Mulch
103*	26	FT/GP or Mulch
841	26	UB
TOTAL	2502	

* = no commercial harvest

UB=underburn

UB*=possible underburn trees<15"

NT = No Treatment

GP= grapple pile through unit <30%slope

HP= hand piling within unit and/or along roads ~100 ft.

FT= no commercial harvest, remove trees <7" dbh

Wildlife gaps in harvest will be UB

All non-heli, UB units will aim to concentrate fuels to reduce them across the entire unit

C. Action Area Description

The action area is defined for ESA purposes as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR 402).

The action area is shown in Figure A-12. The McKenzie River/Elk Creek HUC6 sub-watershed contains the majority of the action area, with some exceptions. One haul route crosses over into the South Fork McKenzie River/Cougar Creek 6th Field HUC; a portion of Unit 54 and one haul route crosses over into the McKenzie Bridge 6th Field HUC; and one haul route crosses over into the Lower Blue River 6th Field HUC. Table 12 summarizes acres of harvest, miles of haul route and relation to LFH outside of McKenzie River/Elk Creek 6th Field HUC. Effects of these actions will be analyzed in the sediment indicator Effects Analysis.

Table 12. Actions Outside of McKenzie River/Elk Creek 6th Field HUC.

Acres of Harvest	Miles of Haul	Haul Road Surface Type (A,N,P)	Wet Weather Haul (Y/N)	Stream Crossings	Stream Type (Peren./Inter.)	Stream Crossings Over LFH	Distance to LFH from Stream Crossing
McKenzie Bridge HUC6							
3.4				0		0	
0	1.3	A	Y	2	Inter.		No Connection
South Fork McKenzie River/Cougar Creek HUC6							
0	0.2	A	Y	1	Peren.	0	1,400'
0	0.7	P	Y	1	Peren.	1	Adjacent
Lower Blue River HUC6							
0	0.7	A	N	1	Inter.	0	No Connection
0	0.1	P	Y	0		0	
0	0.6	A	Y	0		0	
0	0.1	A	N	0		0	

D. Project Mitigation, Best Management Practices and Design Criteria

Table 13 describes the mitigation measures that would be applied in the implementation of the Bridge Thin Project. These measures will be incorporated into individual unit prescriptions to mitigate potential undesirable effects.

Table 13. Project Mitigation, BMPs, and Design Criteria

1.	Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities. Best Management Practices (BMP's), including placement of sediment barriers, provision of flow bypass, and other applicable measures, will be included in project design as necessary to control off-site movement of sediment.
2.	Native surfaced roads would be restricted for hauling during the winter rainy season between October 15 and May 31. The objectives are to maintain water quality and fish habitat.
3.	Construction and or maintenance of roads would not be done when soils are saturated or run-off occurs, to minimize erosion and sedimentation. A stable fill will be constructed across all streams.
4.	All haul roads would be maintained in stable condition. Winter hauling may be allowable when the road surface is either covered with a relatively continuous snow pack or when void of snow when run-off from the road is unlikely. Watering the road surface would be used if roads become excessively dusty during the summer.
5.	Ground-based yarding systems would operate only when soils are relatively dry following the rainy season in the spring through the summer, or during the winter months when there is a continuous snow pack of at least eighteen inches deep or when soils are frozen to a depth of six inches or greater. Operations would be suspended if rainfall or precipitation results in pooling of water in skid trails or landings.
6.	Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible.
7.	Ground-based equipment would be limited to slopes less than 30 percent for harvester/forwarder and conventional ground skidding operations. Short, isolated pitches up to 40 percent on otherwise suitable slopes may be approved after consultation with soil/watershed specialist determines that sediment transport to streams would not occur as a result. Adverse skidding conditions would be avoided through skid trail layout and use of alternative yarding systems.
8.	Ground-based yarding equipment would not be permitted within 120 feet of the stream channel of Class 1, 2, and 3 (fish bearing and perennial non fish bearing streams) streams. Ground-based equipment would not be permitted within 50 feet of the stream channel in Class IV (seasonal, non-fish bearing) streams. In the remainder of the riparian reserve, ground-based equipment is permitted, but would be restricted to existing skid trails from previous entries. Alternative low disturbance ground-based equipment such as shovel yarding is also permitted in the remainder of the riparian reserve.
9.	Regardless of unit harvest prescription, portions of harvest units that lie within riparian reserves would be managed to meet riparian objectives. Prescriptions elements designed to accomplish this are detailed in Table 4.
10.	Full suspension would be required when yarding over perennial stream channels. Where full suspension is not obtainable over intermittent streams, partial suspension would be required and yarding would be limited to when the stream is dry.
11.	Where cable yarding requires corridors through a riparian reserve, corridors would be laid out to result in the least number of trees cut. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would be felled into the channel and left on site.
12.	All skid trails and landings would be water-barred to provide adequate drainage. Water bars location should occur where local terrain facilities effective drainage of the skid trail or landing. In general, water bars should be constructed every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be keyed-in to the cut bank and have a clear outlet on the down hill side. Where available, slash should be placed on skid trails and landings.
13.	Skid trails in thinning units with ground-based yarding would be scarified to a depth of 3-6 inches. Skid trails in regeneration treatments and all landings would be sub-soiled to a depth of 18-22 inches.
14.	All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance would be seeded with non-invasive cereal grains such as winter wheat, and native perennial species.
15.	Temporary roads would be decommissioned after completion of logging operations. Decommissioning of roads may include: berming the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, removal of placed rock, and re-vegetation of the road prism.
16.	In units containing stream channels, all existing large woody debris would be retained within riparian reserves to maintain aquatic objectives.
17.	Water sources used by project operations will be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality.

III. STATUS OF LISTED SPECIES/CRITICAL HABITAT (Bull Trout Only)

A. ESA Status

Bull Trout –

On June 13, 1997, the US Fish and Wildlife Service published in the Federal Register (62 FR 32268) a proposed rule to list the Klamath River population segment of bull trout as an endangered species, and the Columbia River population segment of bull trout as a threatened species. On June 10, 1998, a final rule was published in the Federal Register (63 FR 31647) determining the Klamath River and Columbia River population segments of bull trout to have Threatened status under the Act. At the time of listing, the Service, made the finding that critical habitat was not determinable for these populations because their habitat needs were not sufficiently well known (63 FR 31647). For a further summary of previous Federal actions, see 64 FR 58916.

On January 26, 2001, the Alliance for the Wild Rockies, Inc. and Friends of the Wild Swan, Inc. filed a lawsuit in the U.S. District Court of Oregon challenging the Service's failure to designate critical habitat for bull trout. A settlement agreement was reached on January 14, 2002, which stipulated that the Service would make critical habitat determinations for the five population segments of bull trout (Civil Case No: CV 01-127-JO). For the Klamath River and Columbia River populations, the Service agreed to submit for publication in the Federal Register a proposed rule for critical habitat designation by October 1, 2002, and a final rule by October 1, 2003. A subsequent agreement resulted in extending the date for the publication. The proposed rule was printed in the Federal Register November 29, 2002 and the final critical habitat designation (70 FR 56212) was published September 26, 2005.

Fish distribution of this DPS within the action area and within the McKenzie River watershed is shown in Figure A-3. Critical Habitat designation is shown in Figure A-4. Critical habitat is exempted from designation on Federal lands covered by the NW Forest Plan (Federal Register – Final Rule 6 October 2004). The land ownership along the McKenzie River through the action area is very fragmented, so, for the purposes of this assessment, the entire reach of the McKenzie River and the South Fork McKenzie River that flow through the action area was analyzed as if it were critical habitat. This conservative approach to effects analysis may slightly exaggerate the actual effects to the fragmented, designated critical habitat reaches.

The Matrix Indicators discussed below are described at the 6th field sub-watershed level (McKenzie River/Elk Creek sub-watershed), with the exception of the indicators for population characteristics, which are more appropriately discussed at the 5th Field Watershed level (McKenzie River and South Fork McKenzie River).

B. Population Size and Distribution

Bull Trout –

Bull trout do not spawn in this 6th field sub-watershed. The McKenzie River in this location would provide rearing habitat for subadult and adult bull trout. Bull trout in this river segment are part of the Mainstem fluvial sub-population, and any bull trout that were entrained at Trail Bridge Dam (Trail Bridge adfluvial sub-population) or Cougar Dam (Army Corps of Engineers dam on South Fork McKenzie River – South Fork adfluvial sub-population).

In calendar year 2007, seventy-seven (77) bull trout redds were tallied in Mainstem population spawning sites (note: these spawning sites are in different 5th and 6th field HUCs) (Table 14, Figure A-13). With two fish per redd it is estimated that the population that uses this 6th field sub-watershed is 154 adult bull trout. This is a conservative estimate since some bull trout may spawn biannually, and it is likely that bull trout from the South Fork population and the Trail Bridge population are also found in this 6th field.

Table 14. **Bull trout redd counts from surveys of the mainstem McKenzie population spawning tributaries conducted by ODFW and Forest Service, 1989-2007.**

	Anderson Creek	Olallie Creek	McKenzie below Trail Bridge	Total Mainstem McKenzie
1989	7	-	-	7
1990	9	-	-	9
1991	8	-	-	8
1992	13	-	-	13
1993	15	-	-	15
1994	30	3	-	33
1995	73	10	-	83
1996	82	7	-	89
1997	85	9	-	94
1998	79	7	-	86
1999	77	6	-	83
2000	83	9	-	92
2001	72	6	-	78
2002	60	10	-	70
2003	56	17	0	73
2004	49	12	1	62
2005	47	12	2	61
2006	59	8	1	68
2007	58	15	4	77

Ratliff and Howell (1992) described the mainstem McKenzie bull trout population as “at moderate risk of extinction.” Buchanan and others (1997) upgraded the status of this population to “of special concern” This change was due to 1) recent changes in angling restrictions, 2) increased redd counts, 3) large numbers of migrating fry out of Anderson Creek, and 4) increased numbers of staging adults counted in the main stem McKenzie River.

Since Buchanan upgraded the status of bull trout in the mainstem McKenzie River in 1997, bull trout redd counts decreased from a peak count of 94 in 1997 to a low of 61 in 2005. In the last two year, however, there has been an upward trend (Table 14, Figure A-13). This fluctuation may be a reflection of normal cyclic changes in abundance, but may also reflect other influences on the population. The decrease in redds may reflect a negative effect of the February 1996 flood event on incubating bull trout and young juvenile bull trout, and a depressed rate of recruitment of reproductive age bull trout in the early 2000’s (bull trout become sexually mature at about age 6 and the flood may have impacted several age classes of juvenile bull trout). Another influence upon bull trout abundance is angling harvest. While bull trout are protected with “no angling for bull trout” and catch-and-release regulations, bull trout have been found to be vulnerable to angling, particularly to the use of bait, and fluctuations in abundance may reflect hooking mortality and/or poaching. Still another influence is the removal of bull trout fry from the McKenzie population. Between 1997 and 2007, nearly 15,000 bull trout fry have been removed from Anderson Creek, the primary natal creek for the mainstem McKenzie population, for reintroduction into the Middle Fork Willamette drainage. While rearing habitat continues to appear to be fully seeded in Anderson Creek, the contribution of removed bull trout to overall mainstem McKenzie River production is unknown. Migratory bull trout fry, entering mainstem McKenzie River as rearing habitat, are believed to suffer a high rate of mortality. The rate of mortality among out-migrant fry and early life history in a large river has not been studied and the survival rate among out-migrants can only be speculated upon at this time. Described later in the description of baseline conditions, several habitat factors are functioning at risk. The likelihood fluctuations in bull trout abundance occurred due to changes in habitat conditions is unlikely. Habitat critical to bull trout has been maintained or improved since monitoring of populations began in the early 1990's. In the absence of negative changes to habitat quality, the population size is expected to reflect maintained or positive improvements to habitat conditions (passage improvements, road decommissioning, in-stream improvements, and Northwest Forest Plan riparian protections in forest management activities).

Baseline Condition: Adults in this population are less than 500 but greater than 50. This indicator is *FUNCTIONING AT RISK.*

C. Growth and Survival

Bull Trout –
Bull trout do not spawn in the mainstem McKenzie River in this 6th field sub-watershed. This portion of the river is not suitable since the stream temperatures are not in the preferred range for spawning, incubation, or early rearing. The only known suitable spawning areas for bull trout in the mainstem subpopulation are two spring fed streams (Olallie and Anderson Creeks) which are approximately 14 miles upstream of the Bridge Thin project area.

The best information available for analysis is redd survey results in Anderson and Olallie Creek. The recent numbers in Olallie Creek, relative to the 1990's, show an increase. However, Anderson Creek continues to show lower redd tallies. Anderson Creek had 58 redds in 2007 as compared to a high count of 85 redds in 1997. The total mainstem subpopulation has seen a general decrease from 94 redds in 1997 to 77 in 2007, but has shown an upward trend in the last two years (Table 14, Figure A-13).

Baseline Condition: The steady reduction in the number of redds for the Mainstem population is troubling and of concern, but it does not appear to be based on habitat factors or water quality. Due to this reduction in redd numbers in Anderson Creek this indicator is considered *FUNCTIONING AT RISK*.

D. Life History Diversity and Isolation

Bull Trout –

The McKenzie River bull trout sub-population is a fluvial life history form, but the meta-population exhibits an adfluvial form in the South Fork McKenzie River above Cougar Dam and McKenzie River above Trail Bridge Dam. Both adfluvial forms are adaptations (since the early 1960's) to fragmentation of habitat by impassable dams.

Fluvial bull trout use the McKenzie River as foraging, adult rearing, and migratory habitat. The only known spawning habitat that the Mainstem population successfully utilizes, are Anderson and Olallie creeks which are tributaries to the upper McKenzie River.

Baseline Condition: The Mainstem population is fluvial, and the Trail Bridge and South Fork populations have been forced into a fluvial/adfluvial life history. They appear to be rearing well in the reservoirs, but unsafe downstream entrainment at dams is a concern.

Within this 6th field sub-watershed there are no human caused barriers to bull trout. However the bull trout that utilize this 6th field come from the Mainstem, South Fork, and Trail Bridge populations, and those populations are disconnected from spawning areas due to dams without upstream passage and safe downstream passage. Therefore this indicator is *FUNCTIONING AT RISK*.

E. Persistence and Genetic Integrity

Bull Trout –

At the 5th field watershed level, and the 6th field sub-watershed level there are no connectivity barriers for bull trout. Barriers that do exist (Trail Bridge and Cougar Dams) occur in different 5th field watersheds.

Within the McKenzie River/Elk Creek 6th field sub-watershed no brook trout have been reported by anglers. The only area where brook trout / bull trout hybridization has been documented is in the Trail Bridge sub-population.

Genetic variation within the mainstem McKenzie River bull trout sub-population is of great concern. Effective population size of greater than 500 adults has been recommended for the recovery of evolutionary potential (Franklin and Frankham 1998; Lynch and Lande 1998). The adult bull trout population in the entire McKenzie River watershed is estimated as less than 300.

Baseline Condition: There are no indications of hybridization for the bull trout that utilize the McKenzie River/Elk Creek 6th field sub-watershed. However, due to the existence of Trail Bridge and Cougar Dams (in different 5th field watersheds) and the small effective population size in the McKenzie River watershed, this indicator is considered *FUNCTIONING AT RISK*.

IV. DESCRIPTION OF ENVIRONMENTAL BASELINE

A. General Information

The project area for Bridge Thin Project consists of two tributary drainages (Elk/Cone Creek and Mill Creek) of the McKenzie River, the main stem McKenzie River, as well as glaciated side slopes on the north and south side of the McKenzie River, near Blue River, Oregon (USGS River mile 54 extending upstream to USGS River mile 66, near the confluence of West Fork Horse Creek). The project lies within the McKenzie River/Elk Creek 6th Field Hydrologic Unit (HUC 170900040502; Figure A-2).

The action area is defined for ESA purposes as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402).

The action area is shown in Figure A-12. The McKenzie River/Elk Creek 6th Field HUC sub-watershed contains the majority of the action area, with some exceptions. One haul route crosses over into the South Fork McKenzie River/Cougar Creek 6th Field HUC; a portion of Unit 54 and one haul route crosses over into the McKenzie Bridge 6th Field HUC; and one haul route crosses over into the Lower Blue River 6th Field HUC. Table 15 summarizes acres of harvest, miles of haul route and relation to LFH outside of McKenzie River/Elk Creek 6th Field HUC. Effects of these actions will be analyzed in the sediment indicator Effects Analysis.

Table 15. Actions Outside of McKenzie River/Elk Creek 6th Field HUC.

Acres of Harvest	Miles of Haul	Haul Road Surface Type (A,N,P)	Wet Weather Haul (Y/N)	Stream Crossings	Stream Type (Peren./Inter.)	Stream Crossings Over LFH	Distance to LFH from Stream Crossing
McKenzie Bridge HUC6							
3.4				0		0	
0	1.3	A	Y	2	Inter.		No Connection
South Fork McKenzie River/Cougar Creek HUC6							
0	0.2	A	Y	1	Peren.	0	1,400'
0	0.7	P	Y	1	Peren.	1	
Lower Blue River HUC6							
0	0.7	A	N	1	Inter.	0	No Connection
0	0.1	P	Y	0		0	
0	0.6	A	Y	0		0	
0	0.1	A	N	0		0	

The McKenzie River/Elk Creek 6th Field HUC combined with the Quartz Creek 6th Field HUC make up the McKenzie River/Quartz Creek 5th Field HUC. The McKenzie River flows through the center of the McKenzie River/Elk Creek 6th Field HUC from NE to SW. Quartz Creek is tributary to the mainstem McKenzie River and that portion of the 5th field watershed is downstream of the project area. Therefore, the baseline assessment focuses on the McKenzie River/Elk Creek 6th field HUC since project activities will not effect the Quartz Creek drainage. The 6th field is approximately 20,674 acres – 32 square miles (Table 16).

Table 16. Watershed Information.

Watershed Data Element	Units of Measure	McKenzie River/ Elk Creek 6th Field HUC	McKenzie River/ Quartz Creek 5th Field HUC
Total Size	Acres	20,674	47,764
	Square Miles	32.3	74.6
Non-federal Management	% of Watershed	41.1%	48.7%
Federal Management	% of Watershed	58.9%	51.3%

Elevations exceeding 4,400 feet are located to the north and south of the McKenzie River. McKenzie River elevation ranges from 990 to 1,260 feet within the 6th field watershed. Precipitation averages about 69 inches per year at the 1,200 foot elevation. Approximately 59% of the 20,674 acre analysis area (12,177 acres) is federally managed (Table 1), the remainder is largely privately owned.

The McKenzie River/ Elk Creek sub-watershed is located in the Western Cascades region, and marks the lower extent of Pleistocene glaciation in the McKenzie River sub-basin. The planning sub-watershed is characterized by glacial terraces that are porous (composed of coarse glacial deposits), and infrequently allow channels draining side slopes north and south of the river to make surface water connection to the McKenzie River. Landslides, torrent events and mass wasting, while completely natural and essential to aquatic habitat health over a large scale and long term developmental scale, are often intercepted by the glacial terraces. The broad glacial terraces, ranging in width from 1,000 feet to one mile, are low gradient barriers between the McKenzie River and steep slopes above. The effect to aquatic habitat quality is to intercept the products of disturbance; debris and sediment. The exceptions on the north side of McKenzie Rvier are two small tributaries, Elk/Cone Creek and Mill Creek, and on the south side, two unnamed tributaries. The named tributaries function as typical Western Cascade tributaries that historically delivered debris and sediment to the McKenzie River. Elk Creek continues to function much as it has historically, with a bridge crossing at Hwy 126 allowing most disturbance products to reach the McKenzie River. Mill Creek is more prone have is transport products filtered (woody debris transported by the channel) by the culvert at Hwy 126 crossing.

Elk Creek is largely unmanaged and possesses a low road density. Elk Creek channel conditions reflect a low level of management, with good habitat quality and in-stream wood density. Mill Creek and unnamed tributaries to the north and south of the McKenzie River reflect recent timber management and high road density in their aquatic habitat condition. Low in-stream wood volumes, altered sediment storage capacity and aquatic habitat quality are less able to provide for the life history requirements of native aquatic organisms.

The existing road system is routing soil to stream channels at a higher than natural rate, the road system is in need of repair, upgrading, closures and decommissioning where necessary to reduce fine sediment delivery rate.

B. Land Ownership/Allocation

Table 17 summarizes the Northwest Forest Plan Land Use Allocations at the 6th and 5th Field scales. About 66 percent of federal land is within the Adaptive Management Land Allocation - designed to develop and test new management approaches. About 33 percent is within Late Successional Reserve. All of the units in Bridge Thin lie completely within Adaptive Management Areas. There are no project elements that occur within LSR.

Table 17. Land Use Allocation (NW Forest Plan).

Federal NW Forest Plan Land Use Allocation	% of the Federally Managed Lands	
	McKenzieRiver/ Elk Creek 6th Field HUC	McKenzie River/ Quartz Creek 5th Field HUC
Matrix	0.3	22.4
Administratively Withdrawn	0.5	1.4
Congressional Reserve	0	0
Late Successional Reserve	33.0	35.0
Adaptive Management Area	66.2	41.2

C. Historical Management

Most of the project area is located within previously managed timber stands, thinning or regeneration cuts of 32-80 year old plantations. Approximately 50% of federally managed land in the McKenzie River/Elk Creek sub-watershed has been subject to timber management or road construction since 1930’s. The remainder of privately owned and managed land is largely of a young age (industrial timberlands managed on an approximate 40 year rotation) and/or developed as private or rural residential property. Table 18 summarizes historic management by activity on federal land per decade since the 1940s.

Table 18. Historic Management on Federal Land.

Decade	Historic Management on Federal Land; Acres by Activity Category			
	Regeneration Harvest	Commercial Thinning	Salvage	Pre-commercial Thinning
1940s	710	0	0	0
1950s	69	0	0	0
1960s	664	0	0	0
1970s	395	18	34	267
1980s	478	249	28	284
1990s	532	282	216	312
2000-2010	0	21	15	224

The Riparian Reserve on the north side of the McKenzie River through the action area has a paved highway (Oregon State Highway 126) and a paved local road (McKenzie River Drive), but there are some small pockets of mature/old growth forest. The south side, in general, has a more mature forest or has been previously harvested in the early to mid 1900’s. The Elk Creek/Cone Creek system (a tributary system to the McKenzie River within the 6th field sub-watershed) has had relatively little disturbance and is part of a Late Successional Reserve. The community of Blue River, Oregon also lies within this 6th field sub-watershed.

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has resulted in an increased rate of bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

D. Environmental Baseline Condition

This section provides a description of the environmental baseline for the McKenzie River/Elk Creek 6th field sub-watershed, considered the action area* (see explanation in Section II-C).

Table 19 provides a summary of the current habitat and watershed conditions, as compared to the biological requirements of the listed species from the AP table entitled: *FWS/NOAA Fisheries Table Of Population And Habitat Indicators For Use In The Northwest Forest Plan Area*.

Most of the larger fish bearing streams in the watershed have been surveyed in the past decade. Data collected from these stream surveys, water quality monitoring, queries of the GIS database, and watershed analyses were compared to the default AP values resulting in a determination of the appropriate condition category of Properly Functioning, At Risk, or Not Properly Functioning. This analysis was conducted at the 6th field watershed scale. Two ESA listed species and habitat are assessed below, both present downstream of the project area. A separate determination of condition between species will be made only when there is a difference (between species) within an indicator.

Table 19. Summary of baseline conditions at the action area scale.

Indicator	Environmental Baseline Condition Category McKenzie River/Elk Creek HUC6		
	PF	FAR	NPF
Temperature	X		
Suspended Sediment/Turbidity		X	
Chemicals/Nutrients	X		
Physical Barriers	X		
Substrate Embeddedness		X	
Large Woody Material	X		
Pool Frequency and Quality			X
Large Pools			X
Off-channel Habitat		X	
Refugia			X
Width:Depth Ratio			X
Streambank Condition		X	
Floodplain Connectivity			X
Change in Peak/Base Flows			X
Drainage Network Increase			X
Road Density & Location			X
Disturbance History			X
Riparian Reserves			X
Disturbance Regime			X

PF = Properly Functioning, FAR = Functioning At Risk, and NPF = Not Properly Functioning

<u>Temperature:</u>

In September 1999, a project was implemented to collect stream temperatures in the McKenzie River using Forward Looking Infrared (FLIR) technology (Torgersen, et. al.). This project documented temperatures at the confluence of the mainstem McKenzie and South Fork McKenzie River as 10.5 degrees Celsius and 11.3 degrees Celsius, respectively.

The following table provides maximum 7-day averages for tributaries in the McKenzie River/Elk Creek 6th field sub-watershed. Data collected by Forest Service in 2005.

Table 20. Seven-day average maximum temperature (degrees C) data collected by the Forest Service in 2005.

Stream Name	Geographic Description of Sensor Location	7-Day Average Maximum in Degrees Celsius	Date of Maximum Temperature
Cone Creek	Above private land	16.6	September 10
Mill Creek	Above private land	14.2	September 10
Mill Creek	Below private land	20.0	September 10
Unnamed McKenzie Trib	Mid-slope location near Thor's Hammer. No surface connection to McKenzie River in the summer.	17.4	July 23
Quartz Creek	Above private land	15.5	September 10

Information was reviewed for the USGS gauge that is located immediately adjacent to Bruckart Boat Ramp. The USGS name for this gage location is:

- McKenzie River above South Fork near Rainbow, Oregon.
- USGS ID: 14159110

Table 21. Data from USGS Gage near Bruckart Boat Ramp in 2005.

Date of 7-Day Average Maximum	Temperature in Degrees Celsius
July 20	13.7
August 8, 9, 10, and 11	13.5
September 1	12.2
September 30[a]	9.8

[a] The 7-day avg max for the month of September was on the 1st. The September 30 7-day avg max is provided to show the decreasing trend in temperature during the month of September.

Tributaries that have a surface connection to the mainstem McKenzie River in this 6th field sub-watershed are warm. However, the mainstem remains relatively cold due to the influence of ground water from the upper watershed.

Bull trout use this 6th field to rear as subadults and adults, and as a migratory corridor to upstream spawning areas. The USGS gage shows that the 7-day average maximum in the mainstem did not exceed 15 degrees Celsius.

This is not an area of "high concentration" for chinook spawning (personal communication with Mark Wade of ODFW). The Oregon Department of Fish and Wildlife has conducted aerial redd surveys along the McKenzie River. They found that the highest concentrations occurred from Trail Bridge dam downstream to the McKenzie River Trailhead. From the trailhead down to the confluence with Horse Creek spawning concentrations were considered "light." And finally, from Horse Creek downstream to Finn Rock Bridge (this reach encompasses almost the entire 6th field discussed here) spawning was "moderate." Spawning begins around mid-August and continues thru October with a peak in early October. During that time period temperatures were below 14 degrees Celsius (57 degrees Fahrenheit) providing suitable spawning conditions.

Baseline Condition: Given the temperatures recorded and the life history phases using this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Suspended Sediment – Intergravel DO/Turbidity:

No intergravel DO information is available, however turbidity information is available from the USGS gage near Bruckart Boat Ramp. During the winter of calendar year 2005 there was a high water event that peaked on December 30 and 31. A second event occurred in 2006 on January 10 and 11. The following table displays peak turbidity measurements during the high water at two gages on the McKenzie River that are 14.9 miles apart. The gage near Vida, OR is an indicator of the influence of private land management, especially in Quartz Creek. During the high water events field investigations showed a stark difference in turbidity upstream and downstream of Quartz Creek. The gage above the South Fork near Rainbow, OR has private land influence, but since the land base upstream of this gage is predominantly National Forest System it is a reasonable indicator of conditions upstream.

Table 22. Turbidity measurements from USGS gages on the McKenzie River

Location of Gage	Date	Turbidity in FNU[a]	Discharge in cfs
McKenzie River above South Fork Near Rainbow, OR (River Mile 62.3)	12/30/2005	139.0	18,662
	12/31/2005	139.0	18,706
	01/10/2006	139.0	18,313
	01/11/2006	139.0	18,313
	02/01/2006	4.2	6,727
McKenzie River near Vida, OR (River Mile 47.4)	12/30/2005	332.0	21,769
	12/31/2005	236.0	21,809
	01/10/2006	169.0	20,745
	01/11/2006	332.0	21,373
	02/01/2006	329.0	12,204

[a] An FNU is a Formazin Nephelometric Unit. It is a measure of turbidity commonly used in Europe and is similar to Nephelometric Turbidity Unit (NTU). The difference is based on the wavelength used to make the measurement. NTUs are measured with a white light, while FNUs are measured with an infrared light. Due to the fact that suspended particles scatter light of different wavelengths with varying efficiency, FNU data often are not directly comparable to NTU data.

These turbidity events were relatively high for the McKenzie River hydrologic regime. The readings at the two gages show high turbidity that occurred during a storm, but the high turbidity on February 1 was from a slide on private land in the Quartz Creek watershed downstream of National Forest System lands. This information is only used for comparison to turbidity conditions on the same day at the upstream gage that is a reasonable indicator for conditions in the McKenzie River/Elk Creek 6th field sub-watershed.

Baseline Condition: Relative to measurements downstream of National Forest System lands, turbidity in the McKenzie River/Elk Creek 6th field sub-watershed is considered “moderate.” On the high water event on 12/30/2005 the upper gage was 193 FNUs lower than the lower gage that is approximately 9 river miles downstream of National Forest System lands. The FNU graphs show that the high water events caused a spike in turbidity, but they also show that during the spawning and incubation season in the McKenzie River/Elk Creek 6th field turbidity conditions were low to moderate. This indicator is *FUNCTIONING AT RISK*.

Chemical Contamination/Nutrients:

The McKenzie River is not listed as 303d for chemicals. There are no agricultural, industrial, or other sources of chemical contamination. It is likely that hydrocarbons on Highway 126 get washed into the river during rain events. This 6th field does however have a number of private residences, and mixed ownerships. It is unknown if, or at what level, chemicals from private residences, the town of Blue River, and private timberlands are entering the McKenzie River in this 6th field sub-watershed.

Baseline Condition: Since there is no indication of chemical contamination in this 6th field, this indicator is *PROPERLY FUNCTIONING*.

Physical Barriers:

There are no physical barriers to either upstream or downstream migration in the 6th field sub-watershed. Major streams entering the mainstem McKenzie River in this sub-watershed either have bridges or culverts that do not prevent passage.

Baseline Condition: Given the absence of human caused barriers to bull trout and spring Chinook salmon in this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Substrate Character and Embeddedness:

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).
The two major river systems that enter into the McKenzie River/Elk Creek 6th field sub-watershed are Blue River and South Fork McKenzie River. They are each independent 5th field watersheds, and both have Army Corps of Engineers flood control dams (Blue River dam at about river mile 1.5; and Cougar Dam at about river 4.5). Each of these dams traps tens of thousands of cubic yards of sediment.

Baseline Condition: The specific measurement has not been taken throughout the mainstem river in this 6th field sub-watershed. Visually it appears that cobble and gravel dominate the channel in this 6th field, and bedload material is well sorted. This indicator is *FUNCTIONING AT RISK*.

Large Woody Material:

In this 6th field watershed, two inventories have been conducted to count wood in the McKenzie River. One was done in 1997 to evaluate large wood associated with the "Mile Post 44 Logjam" and the other was done in 1999 (Bennett) that covered areas in the 6th field not evaluated by the 1997 effort.

The 1997 (Clearwater Biostudies) evaluation looked at wood in the river from the confluence with the South Fork McKenzie River upstream to Belknap Bridge (upstream of Dearborn Island). This evaluation reach is approximately 4 river miles in length. The following table provides counts of woody material in the reach.

Table 23. Woody Material in the area of the MP 44 Logjam

Location	Pieces of large woody material (>10' long, 12" diameter)	Key Pieces of large woody material (>30' long, 20" diameter)
Associated With Mile Post 44 Logjam	151[a]	66
River Meander Near Mile Post 44 Logjam	57	24
Remainder of Study Reach	26	14
Total	234[a]	104

[a] Count of woody material associated with the Mile Post 44 jam was a significant underestimate due to an abundance of pieces deep within the jam which could not be enumerated.

Twenty-six pieces of woody material in the jam area were measured to be over 100' long and six were more than 150' long. The largest piece of woody material in the study area was 182' long with bark and root wad still attached. Since the time of the study in 1997, at least 5 more pieces had entered the MP 44 Log Jam area. However, during the high water events of December 2005 and January 2006 dynamic changes took place at the log jam. Woody material was transported downstream and much of it can be found at the heads of islands in this 6th field. Large trees with partial crowns and with root wads attached were also deposited in the log jam area. Channel shifts took place and gravels and cobbles were mobilized, transported, and deposited into new areas. This specific segment of the McKenzie River where the log jam occurs is the most dynamic and complex of the "upper river" (upstream of Vida, OR).

An updated inventory has not been accomplished since the changes, the jam area and the 6th field remains rich with woody material. The deposits at the heads of islands will provide for long-term maintenance of off channel habitats, and provide cover during future high water events. The log jam area remains a complex network of rearing, spawning and migratory channels for spring Chinook salmon.

In addition to the wood counted in the Mile Post 44 Logjam study (Clearwater Biostudies 1997), the following wood was counted in 1999 by a contractor (Bennett) in areas of the 6th field that were not covered in the 1997 inventory.

Table 24. Woody material inventory conducted by Bennett (1999)

Size of Woody Material	Pieces
Small (25' x 12")	59
Medium (50' x 24")	10
Large (50' x 36")	0

Baseline Condition: Given the amount of woody material inventoried, this indicator is *PROPERLY FUNCTIONING*.

Pool Frequency and Quality; and Large Pools:

The McKenzie River varies in width in the 6th field sub-watershed. It ranges from 100 to 200 feet throughout the sub-watershed. In the "South Fork to Finn Rock" reach there are approximately 2.5 large pools per mile in a segment where the river is over 65 feet wide.

The following table is from Minear (1994) and shows changes in large pools in two reaches of her study. Minear looked at changes between 1938 and 1991 using aerial photos. A large pool was defined as a pool with a minimum depth of 2 meters and an area of at least 40 square meters.

Table 25. Changes in Large Pools

Reach	1938 Number of Pools	1991 Number of Pools	Percent Change
Rainbow to South Fork Junction	22	6	-73%
South Fork to Finn Rock	21	13	-38%

The McKenzie River/Elk Creek 6th field sub-watershed has had private land development, the town of Blue River is partially in the 6th field, and Highway 126 or McKenzie River Drive are adjacent to the river almost along the entire length in this 6th field. The presence of these paved roads prevents full riparian development on the north side of the river, and constrains the river. These conditions are not conducive to the promotion of large pools in a river channel.

Baseline Condition: There have been dynamic changes to the river since the 1991 aerial photograph series (e.g. the 1996 floods, and smaller events). However, a similar exercise to inventory pools with aerial photos has not taken place, nor has a ground inventory of pools. Given the reductions in large pool habitat found by Minear (1994), the low number of large pools that are found in the 6th field, and the chronic effect of paved roads adjacent to the river throughout much of the 6th field sub-watershed, this indicator is *NOT PROPERLY FUNCTIONING*.

Off Channel Habitat:

The following table displays the changes in side channel numbers and length found by Minear (1994) using aerial photos in the 6th field sub-watershed.

Table 26. Changes in side channel numbers and length found by Minear (1994) using aerial photos

Reach	Number of Side Channels 1945/49	Number of Side Channels 1986	Side Channel Length (m) 1945/49	Side Channel Length (m) 1986
Rainbow to South Fork Junction	21	7	6,027	973
South Fork to Finn Rock	7	9	5,957	3,077

The Mile Post 44 Log Jam is located at the lower end of the “Rainbow to South Fork Junction” reach and has undergone dynamic changes since the 1986 photo time series, as has the “South Fork to Finn Rock” reach. The large woody material deposits at the heads of islands will provide for long-term maintenance of off channel habitats, and provide cover during future high water events. The log jam area remains a complex network of rearing, spawning and migratory channels for spring Chinook salmon.

Baseline Condition: Channel complexity is high in this section of the “upper river” (i.e. upstream of Vida, OR). This can be attributed to geomorphic conditions and geographic location. The lower boundary of this 6th field sub-watershed is near the lower terminus of Pleistocene glacial advance (Upper McKenzie River Watershed Analysis 1995). Downstream of this 6th field the McKenzie River channel is influenced by the Western Cascade geology and naturally becomes more constrained relative to the glacial-valley segment of the McKenzie River/Elk Creek 6th field sub-watershed. The reach of river from the South Fork to Finn Rock is geomorphically set up to have high channel complexity. However, due to the presence of Highway 126 and McKenzie River Drive the channel is constrained on the north side and inhibits lateral scour. This indicator is *FUNCTIONING AT RISK*.

Refugia:

The McKenzie River has habitats capable of supporting strong and significant populations. However, many human activities take place in the upper watershed and that is especially true in the McKenzie River/Elk Creek 6th field sub-watershed. The presence of Highway 126 and McKenzie River Drive (both paved roads) adjacent to the river, mixed ownership, numerous private residences within the river valley and some directly adjacent to the river, and recreational boating.

Baseline Condition: This 6th field does not function as a "refugia" and is therefore *NOT PROPERLY FUNCTIONING*.

Width to Depth Ratio:

Width to depth ratios have not been physically collected in the main stem McKenzie River. The following is an estimate of bankfull width (using a range finder), and a visual estimate of bankfull depth. The McKenzie River/Elk Creek 6th field sub-watershed is in a segment of the McKenzie River where two large flood control dams impact the sediment and flow regime.

Table 27. Estimated width to depth ratio at Bruckart boat launch

Site description	Bankfull width	Bankfull depth	Bankfull width/depth
Current Bruckart boat launch site	160	7	22

Baseline Condition: An estimate of the bankfull width to depth ratio is greater than both criteria in the matrix of indicators (20 for bull trout; 12 for spring Chinook salmon). This indicator is *NOT PROPERLY FUNCTIONING*.

Streambank Conditions:

Streambank conditions in the 6th field in general are good. However, some of the banks along the McKenzie River in the 6th field have been reinforced with rip-rap (eg. at the head of Dearborn Island). Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

Baseline Condition: Streambank conditions in the 6th field in general are good. However, due to the presence of paved roads that have required rip-rap in places, and the presence of some private residences along the river that have placed rip-rap along the bank, this indicator is *FUNCTIONING AT RISK*.

Floodplain Connectivity:

Floodplain connectivity is a concern in this 6th field sub-watershed due to the presence of flood control dams (Cougar and Blue River) in tributary 5th field watersheds. These dams do not allow peak flows to inundate the floodplains in a similar spatial and temporal frequency as compared to historic conditions. In addition there are areas of rip-rap along the river bank that do not allow lateral scour to occur.

Baseline Condition: Given the presence of flood control dams in tributary 5th field watersheds and changes to natural bank conditions, this indicator is *NOT PROPERLY FUNCTIONING*.

Changes in Peak/Base Flows:

Upstream of the McKenzie River/Elk Creek 6th field sub-watershed the flow regime is not impacted by flood control dams, so the hydrologic regime that flows into this 6th field is "natural" for the most part. However, there are two tributary 5th field watersheds (South Fork and Blue River) that enter this 6th field that have significantly affected the hydrograph as compared to historic conditions.

Baseline Condition: Due to the presence of two flood control dams, the peak and base flows in this 6th field sub-watershed are not characteristic of historic conditions. Therefore, this Indicator is *NOT PROPERLY FUNCTIONING.*

Increases in Drainage Network:

There is significant mixed ownership in this 6th field. There is a State highway (Hwy 126), municipal roads (the town of Blue River), private timber company roads, other private land holder roads, and Forest Service roads.

Many roads in the 6th field are paved roads administered by the State of Oregon or the Forest Service and are in good shape. However, Highway 126 and McKenzie River Drive have a significant impact on the river due to their location.

Baseline Condition: This indicator is *NOT PROPERLY FUNCTIONING*.

Road Density and Location:

There is significant mixed ownership in this 6th field. There is a State highway (Hwy 126), there are municipal roads (town of Blue River), private timber company roads, other private land holder roads, and Forest Service roads. Many roads in the 6th field are paved roads administered by the State of Oregon or the Forest Service and are in good shape. However, Highway 126 and McKenzie River Drive have a significant impact on the river due to their location.

The following table displays existing road densities for all roads in the 5th Field and 6th Field watersheds.

Table 28. Existing Road Densities

Location	Density All Roads
McKenzie River/ Quartz Creek 5th Field Watershed	3.7
McKenzie River/ Elk Creek 6th Field Watershed	4.0

Baseline Condition: The density ratio of 3.7 is considered Not Properly Functioning for bull trout and for Chinook salmon. Private timber lands in Quartz Creek do not have the rigorous requirements of the Northwest Forest Plan, and harvest activities are substantial. When taking into account the watershed impacts caused by private timber harvest, this indicator is considered *NOT PROPERLY FUNCTIONING* at the 5th field watershed level.

Disturbance History:

This 5th field watershed (McKenzie River/Quartz Creek - 1709000405) has a history of significant human caused disturbance.

Timber harvest by private companies has been extensive in the past and continues to the present. The Forest Service has acquired lands along the river terraces that was clear cut using ground based yarding methods. These lands were cut 50 to 60 years ago and many of the old roads are in disrepair. The Forest Service has also extensively managed portions of the river terraces in the past (Mill Creek area). Those stands are currently 30 to 50 years old and densely stocked. In the Quartz Creek portion of the 5th field watershed extensive clear cutting continues by a private timber company.

Oregon State Highway 126 and other roads have had negative impacts on the watershed by constraining the river, permanently removing riparian areas, and providing an avenue for chemical spills.

Baseline Condition: Given the human caused disturbance that has occurred in the past, and continues in the present, this indicator is *NOT PROPERLY FUNCTIONING*.

Riparian Reserves:

There are approximately 4,561 acres of Riparian Reserve on National Forest System lands in the 5th field watershed. Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

Many of the Riparian Reserves in the 5th field either have had some form of timber harvest, or there is a residence, or a road (paved or gravel). The Riparian Reserve on the north side of the river is a paved highway, but there are some small pockets of mature/old growth forest. The south side, in general, has a more mature forest. The Elk Creek/Cone Creek system has had relatively little disturbance and is part of a Late Successional Reserve.

Baseline Condition: Due to the presence of Highway 126, McKenzie River Drive, and the amount of residential development along the river in the McKenzie River/Elk Creek 6th field sub-watershed, and the substantial amount of timber harvest in the Quartz Creek 6th field sub-watershed, this indicator is *NOT PROPERLY FUNCTIONING*.

Disturbance Regime:

There has been significant human disturbance in this 5th field in the form of road building, timber harvest, private land development, and flood control dams in tributary 5th field watersheds that significantly impact the disturbance regime of the McKenzie River/Elk Creek 6th field sub-watershed.

Baseline Condition: The extent of human induced disturbance, and interruption of disturbance (i.e. flood control dams) have created conditions in the 5th field watershed that are *NOT PROPERLY FUNCTIONING*.

Integration of Species and Habitat Conditions (Bull Trout Only):

Bull trout use this 6th field as a foraging area for sub-adults and adults. Adult bull trout also use this 6th field as a migratory corridor upstream to the spawning tributaries of Olallie and Anderson Creeks.

Despite the high amount of human influence in the McKenzie River/Elk Creek 6th field sub-watershed, the river still provides good water temperatures and complex habitat for bull trout. This section of the McKenzie River contains the most complex habitat in the upper river due to the presence of the Mile Post 44 logjam. However, it can only be considered to be functioning at risk due to the human impacts.

Flood control dams have significantly altered the disturbance regime; river banks and terraces have had significant development; and Highway 126 and McKenzie River Drive directly impact the river throughout much of the 6th field. These are chronic cumulative effects that will continue to impact the river into the foreseeable future.

Baseline Condition: This indicator is *FUNCTIONING AT RISK*.

E. Bull Trout Critical Habitat – Environmental Baseline Condition, Critical Habitat PCEs

Critical Habitat has been designated for Columbia River bull trout in the Willamette River basin (Final Rule September 26, 2005). This designation includes some river segments within the McKenzie River / Elk Creek 6th field sub-watershed (HUC). The USFWS has determined there are 8 primary constituent elements (PCEs) essential for the conservation of bull trout. These are sites and habitat components that support one or more life stages, including:

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72^{o} F (0 to 22^{o} C) but are found more frequently in temperatures ranging from 36 to 59^{o} F (2 to 15^{o} C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and season variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout are specifically excluded from designation;
2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.
3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. Should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.
4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;
5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;
6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;
7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;
8. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

The Critical Habitat designation protects PCEs necessary to support the life history functions which were the basis of the designation. Because not all life history functions require all the PCEs, not all habitat will contain all the PCEs.

Each of the areas designated in the final rule have been determined to contain sufficient PCEs to provide for one or more of the life history functions of bull trout. In some cases, the PCEs exist as a result of ongoing federal actions. As a result, ongoing federal actions at the time of Critical Habitat designation are included in the baseline in any consultation conducted subsequent to the designation.

Water Temperature Baseline Condition

The indicator condition for water temperature is Properly Functioning. For additional information see the discussion above.
The segment of the McKenzie River where the Bridge Thin project is located is used by bull trout for adult and sub-adult rearing. Buchanan and others (1997) found that adult bull trout required temperatures of 4 to 20^{o} C, but that densities were highest at 12^{o} C or less. The following table provides temperature collected during the calendar year of 2005 at the USGS gage near Bruckart boat launch which is located within this 6th field HUC.

Table 29. Monthly Mean Temperature Calendar Year 2005 at McKenzie River above South Fork near Rainbow, Oregon. USGS ID: 14159110.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
5.18	5.30	6.45	6.98	8.44	9.44	11.10	11.07	9.38	8.10	6.31	*

*Data incomplete and unavailable.

Temperatures are less than 12^{o} C throughout the year in this segment of the McKenzie River. Therefore, the baseline condition for this PCE is *PROPERLY FUNCTIONING*.

Complex Stream Channel Baseline Condition

The habitat indicators that are associated with this PCE were a mix of existing condition. Large wood was Properly Functioning, pools were Not Properly Functioning, and off channel habitat was Functioning at Risk.

Given the human impacts in this segment of the McKenzie River (Highway 126, McKenzie Bridge Drive, private land development and associated rip rap along the river) this PCE is *FUNCTIONING AT RISK*.

Substrate Baseline Condition

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

The specific measurement has not been taken throughout the mainstem river in this 6th field sub-watershed. Visually it appears that cobble and gravel dominate the channel in this 6th field, and bedload material is well sorted. This PCE is considered *FUNCTIONING AT RISK*.

Hydrograph Baseline Condition

Upstream of the McKenzie River/Elk Creek 6th field sub-watershed the flow regime is not impacted by flood control dams, so the hydrologic regime that flows into this 6th field is “natural” for the most part. However, there are two tributary 5th field watersheds (South Fork and Blue River) that enter this 6th field that have significantly affected the hydrograph as compared to historic conditions.

Due to the presence of two flood control dams, the peak and base flows in this 6th field sub-watershed are not characteristic of historic conditions. Therefore, this Indicator is *NOT PROPERLY FUNCTIONING*.

Seeps, Springs, and Groundwater Sources Baseline Condition

Ground water sources are dominant in the upper McKenzie River 5th field HUC (upstream of this segment of the river). The geology of this 6th field (Western Cascades Province) do not have an abundance of cold water springs. This area has deep glacial deposits within the river corridor and this strongly influences hyporheic flow in the 6th field. The characteristics of tributary streams in this area during the summer are that they have perennial flow in the steep canyon areas and go subsurface when they reach the glacial deposits. This keeps characteristically warm Western Cascades water temperatures from reaching the mainstem river. This PCE is *PROPERLY FUNCTIONING*.

Migratory Corridors Baseline Condition

There are no physical barriers to either upstream or downstream migration in the 6th field sub-watershed. Major streams entering the mainstem McKenzie River in this sub-watershed either have bridges or culverts that do not prevent passage.

Given the absence of human caused barriers to bull trout in this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Food Base Baseline Condition

The only information available for macroinvertebrates in this segment of the McKenzie River is from a sample collected in 1999 in Cone Creek (a tributary in this 6th field). A benthic invertebrate assessment was conducted by Aquatic Biology Associates, Inc. A summary score of 81.5 was determined which is considered “High biotic/habitat integrity.” There is no indication that the fish prey base is limiting for adult and subadult bull trout in this 6th field HUC. Therefore, this PCE is considered to be *PROPERLY FUNCTIONING*.

Permanent Water Quality and Quantity Baseline Condition

Ground water influences in the McKenzie River provide for relatively high base flows during the summer. Cougar Dam has recently been retrofitted with a temperature control tower that provides temperatures that better emulate historic conditions below the dam. The Army Corps of Engineers has estimated that the tower influences temperature conditions as far downstream as Vida, Oregon. There are no indications of adverse water quality conditions in this 6th field HUC. Therefore, this PCE is considered to be *PROPERLY FUNCTIONING*.

F. Spring Chinook Salmon Critical Habitat - Environmental Baseline Condition, Critical Habitat PCEs

Critical Habitat has been designated for Upper Willamette River Chinook salmon. This designation for Chinook salmon includes the reach of the McKenzie River flowing though the Action Areas. NMFS has determined that there are six primary constituent elements (PCEs) essential for the conservation of Chinook salmon. These are sites and habitat components that support one or more life stages, including:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2) Freshwater rearing sites with:

   (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
   (ii) Water quality and forage supporting juvenile development; and
   (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;
4) Estuarine areas free of obstruction and excessive predation with:
   (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
   (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
   (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5) Nearshore marine areas free of obstruction and excessive predation with:
   (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and
   (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Only PCEs 1-3 are found within the 6th field subwatersheds. The baseline condition of these PCEs is described below:

Freshwater Spawning Sites: Baseline Condition

The McKenzie River in the project area provides favorable spawning sites for spring Chinook salmon. The Oregon Department of Fish and Wildlife has conducted aerial redd surveys along the McKenzie River. They found that the highest concentrations occurred from Trail Bridge dam downstream to the McKenzie River Trailhead. From the trailhead down to the confluence with Horse Creek spawning concentrations were considered "light." And finally, from Horse Creek downstream to Finn Rock bridge spawning was "moderate.

Stream temperatures in this segment of the McKenzie River are favorable for all life history stages of spring Chinook salmon (see discussion of this indicator and Table 29 in the bull trout PCE discussion above). This PCE for spring Chinook is *PROPERLY FUNCTIONING*.

Freshwater Rearing Sites: Baseline Condition

Downstream of Belknap Springs as the river makes its bend westward, it becomes less constrained as it flows through a glacial valley. More physical features in the channel (i.e. islands) can be found with an associated increase in channel complexity and log jams. This reach provides abundant rearing habitat for juvenile spring Chinook salmon.

Minear (1994) found a significant reduction in the number of pools between Horse Creek and Finn Rock (near Quartz Creek) by comparing changes in aerial photos thru a number or time series. Adjacent to this segment of river are McKenzie River Drive and Oregon State Highway 126. In some sections these paved roads are directly adjacent to the McKenzie River and this has impacted important source areas of large wood. This segment of the river still provides important rearing areas due to the number of side channels.

The Mile Post 44 Log Jam is located in the McKenzie River/Elk Creek 6th field sub-watershed. The log jam area is a complex network of rearing, spawning and migratory channels for spring Chinook salmon. The large woody material deposits at the heads of islands in this 6th field sub-watershed will provide for long-term maintenance of off channel habitats, and provide cover during future high water events.

Stream temperatures in this segment of the McKenzie River are favorable for all life history stages of spring Chinook salmon (see discussion of this indicator and Table 29 in the bull trout PCE discussion above). This PCE for spring Chinook is *PROPERLY FUNCTIONING*.

Freshwater Migration Corridors: Baseline Condition

Within the project area there are no barriers to spring Chinook migration. The McKenzie River in the project area provides suitable stream temperatures for both adult and juvenile migration. Stream flows in Western Cascades are flashy and have low base flows in the late summer and early fall (spawning season). However, the spring fed streams from the High Cascades provide a relatively high discharge in the summer and buffers the effects of the Western Cascades low base flows. This PCE is *PROPERLY FUNCTIONING*.

V. EFFECTS OF THE PROPOSED ACTION

A. Introduction

The effects to baseline habitat indicators were assessed for each of the project elements: 1) Timber Felling 2) Timber Yarding, 3) Timber and Rock Haul, 4) Road, Rock Pit and Landing Work, 5) Fuel Treatment

The potential effects (negative, positive, or neutral) that the implementation of each project element may have on each indicator or group of indicators was assessed, where applicable, using the AP factors as defined below:

Proximity ~ The geographic relationship between the project element or action and the species/designated critical habitat.

Probability ~ The likelihood that the species or habitat will be exposed to the biotic or abiotic effects of the project element or action to the indicator.

Magnitude ~ The severity and intensity of the effect.

Distribution ~ The geographic area in which the disturbance would occur (may be several small effects or one large effect).

Frequency ~ How often the effect would occur.

Duration ~ How long the effect would last. Potential categories include (a) short-term event whose effects subside immediately (pulse effect); (b) sustained, long-term effect, or chronic effect whose effects persist (press effect); and (c) permanent event that sets a new threshold for a species' environment (threshold effect).

Timing ~ When the effect would occur in relation to the species' life-history patterns.

Nature ~ Effects of the action on elements of a species' life cycle, population size or variability, or distribution; or on the primary constituent elements of critical habitat, including direct and indirect effects.

As the AP directs, the Proximity, Probability, and Magnitude factors are to be considered first. If either of the following conclusions is made, no further analysis of the PE for that indicator is needed:

1) There is no probability or there is a discountable (extremely unlikely to occur) probability of the impact occurring; and/or
2) The magnitude of the effect is insignificant (not able to be meaningfully measured, detected, or evaluated) or non-existent.

The combined effects to each of the indicators were also assessed for the project as a whole (Indicator summary).

B. Project Effects to Habitat Indicators

Temperature	Baseline Condition	
	Action Area	HUC6
	PF	PF

1) Timber Falling

a) Proximity: In previously unmanaged units, no trees >7”dbh will be cut within 300 feet of fish-bearing streams or LFH, within 60 feet of perennial, non fish-bearing streams, and within 30 feet of intermittent, non fish-bearing streams. In previously managed units, no trees >7”dbh will be cut within 60 feet of all perennial streams or LFH, and within 30 feet of intermittent, non fish-bearing streams.

b) Probability: The effect that this project will have on stream shade was estimated using the model described in the “Northwest Forest Plan Temperature TMDL Implementation Strategies” (USDA and USDI 2005). This model provides the process for calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1000 and 1400 hours), known as the primary shade zone. It also provides the process for calculating the width of the riparian area that provides shade in the morning and afternoon (0600-1000 hours; 1400-1800 hours), considered to be the secondary shade zone. In over-dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun’s solar radiation (USDA and USDI 2005).

The TMDL Implementation document suggests that thinning in Riparian Reserves could be considered as long as they meet the following conditions:

1. Vegetation density is high and will benefit from thinning.
2. Vegetation thinning will not occur in the primary shade zone. Vegetation thinning in the secondary shade zone will not result in less than 50% canopy closure post harvest.
3. NWFP Standards and Guidelines and BMPs still apply.
4. The width of the primary shade zone will be set using the values below, unless a shade model is used for site specific analysis.

Table 30. Minimum Width of Primary Shade Zone (in feet) based on Slope and Tree Height (USDA and USDI 2005).

TREE HEIGHT	HILL SLOPE		
	<30	30 TO 60	>60
< 20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60

Depending on slope, the width of the primary shade zone for units in the Bridge Thin action area ranges from 50 feet to 60 feet (Table 30). Thinning will not occur within the primary shade zone of any perennial stream. Thinning in the remainder of the riparian reserve of any perennial stream (two site-potential tree heights on fish-bearing streams and one site-potential tree height on all non-fish bearing, perennial streams), will not result in less than 50% canopy closure post harvest. This will include those portions of the riparian reserve that are providing secondary shade. Therefore, thinning prescriptions in riparian reserves for Bridge Thin meet all four conditions recommended by the TMDL Implementation document. Based on field observation and compliance with the aforementioned conditions, the probability of timber falling effecting stream temperature is **discountable**.

Element Summary: The Project Design Criteria were developed to protect stream temperature and ensure that sufficient shade will remain for the streams in the Bridge Thin action area. Thinning prescriptions in riparian reserves meet all four conditions recommended by the TMDL Implementation document. Therefore, the probability of timber felling affecting stream temperature is **discountable**.

2) Timber Yarding

a) Proximity: Approximately 57 skyline corridors are proposed over 8 perennial streams in the action area. Only three of these streams flow into the McKenzie River (LFH/CH). Skyline corridor widths are about 10 feet (thinned tree spacing in riparian reserve stands will be about 20 feet). The nearest distance to LFH from a corridor is over 1.0 mile.

b) Probability: Typically, corridor widths are 10 feet wide and eliminate very little actual effective shade. Minor reduction in stem density immediately adjacent to channels from the corridor is expected with construction of 57 corridors across perennial streams. The net area of corridor opening in the primary shade zone adjacent to perennial channels would be 1.6 acres – 0.06% of the 2,531 riparian reserve acres on federal land in the 6th Field. Skyline corridors would be spaced at least 100 feet apart to reduce additive effects. Skyline yarding equipment would not be permitted within 120 feet of all perennial stream channels. Trees felled for corridors would be left on site. Mitigations requiring full suspension over channels and retention of immediate LWD to the channel is expected to protect understory vegetation close to the channel and retain some shade provided by downed wood. Any effect that does occur would be of short duration as the young stands would be expected to re-close openings in 3 to 5 years, based on rates of new growth. Due to the relatively small area of stream adjacent opening, the probability of increasing stream temperature any amount is considered **discountable.**

Element Summary: Due to project design criteria and relatively small area of stream adjacent opening, timber yarding has **discountable** probability of having a negative effect on the stream temperature indicator.

3) Timber and Rock Haul

a) Proximity: Timber and rock haul routes are proposed adjacent to LFH.

b) Probability: Timber and rock haul have no casual mechanism to affect stream shade therefore there is no probability to affect stream temperature.

Element Summary: Because there is no probability to affect stream temperature timber and rock haul will have a **neutral** affect to the stream temperature indicator.

4) Road, Rock Pit and Landing Work

a) Proximity: A variety of road construction, reconstruction, maintenance, closure and decommissioning, culvert replacements and rock pit development will occur within the action area. No new road construction will occur within riparian reserves except one semi-permanent spur road that crosses two intermittent streams with no surface connection to LFH (Unit 2; Figure A-8). None of these components will occur adjacent to LFH, but road maintenance and reconstruction will occur adjacent to some perennial streams hydrologically connected to LFH.

b) Probability: Proposed road maintenance and reconstruction on approximately 34 miles of existing road may require removal of small understory vegetation – brushing – within riparian reserves. Brushing alongside roads has no causal mechanism to effect water temperature because it does not remove shade canopy. In addition, no stream shade will be lost due to road closure and decommissioning. Because road maintenance, reconstruction, decommissioning and closure will not effect stream shade and the new semi-permanent road is over streams that have no connection to LFH, the potential for increasing stream temperature is **discountable**.

Element Summary: No shade canopy over streams hydrologically connected to LFH will be removed by brushing and other road work. Therefore, effects are characterized as **discountable** to the stream temperature indicator.

5) Fuels Treatment

a) Proximity: Proposed fuel treatment will not occur within the no-treatment buffers, which are located outside of the primary shade zone (60 feet) on all perennial streams. All equipment is restricted 120 feet from perennial streams and 50 feet from intermittent streams. Fire treatment units with the closest proximity to LFH are Units 95, 97, 98, 102 and 103, which are adjacent to the McKenzie River. Two paved roads, McKenzie River Drive and King Road, pass through these units and parallel the McKenzie River (Figure A-14). These roads are approximately 100 feet away from the river. No fuels treatment will occur on the river side of the paved roads. Therefore, the 60 foot no-treatment buffers will be exceeded in these units.

b) Probability: Removal of trees <7"dbh for fuels treatment will not result in change to the overstory canopy and therefore will have no causal mechanism to effect stream temperature.

In units treated with an underburn (up to 1,656 acres) or natural fuels underburn (up to 42 acres) no ignition will occur inside the no-treatment buffers, but fireline will not be constructed within the riparian reserves. Therefore, fire may back down into the primary shade zone. Burning will occur in spring-like conditions with high moisture content in the larger fuels >3", so the likelihood of fire removing shade canopy is very low. If trees begin to torch, firefighters will use water to reduce the fire intensity and to keep fire in the ground fuels. The only units adjacent to LFH (Units 95, 97, 98, 102 and 103) will have the two paved roads to serve as substantial fire line, with no treatment in-between the road and the McKenzie River.

Most of the streams within units do not have surface connection with the McKenzie River (LFH). There are five tributaries with surface connection to LFH that have fire treatment units in the uplands. In all tributaries, there is substantial length of stream channel that have no management activities associated with this project and are heavily forested to facilitate cooling effects before reaching LFH. In addition, all tributaries flow through the wide, porous, glacial terrace in the McKenzie River valley and have high hyporheic interaction. These channel lengths from the lowest treatment unit to the McKenzie River (LFH) are as follows:

- *Mill Creek* = 6,250 feet
- *Unnamed Tributary through Tokatee Golf Course* = 5,600 feet
- *Tributary out of Unit 100* = 1,650 feet
- *Tributary out of Unit 95* = 1,280 feet
- *Tributary from West Side of Project Area* = 3,800 feet with small unit (21) in-between; 6,900 feet from upland units

Based on monitoring of past underburning on the District, it is anticipated that underburning will not remove any overstory shade trees. Risk of underburn leading to torching of trees is very low due to high fuel moisture conditions and availability of water at time of burning. In addition, the channel length downstream of units that is forested, unmanaged, and having hyporheic interaction is substantial to promote cooling. Therefore, the probability that prescribed fire will affect stream temperature is **discountable**.

Element Summary: Because fire will be allowed to back down into the primary shade zone, so that construction of fireline in riparian reserves can be avoided, there may be potential to affect shade canopy. Implementation in high moisture conditions and use of water to keep fire in the ground fuels will reduce the potential. Based on monitoring of past of underburning on the District, it is anticipated that underburning will not remove any overstory shade trees. Risk of underburn leading to torching of trees is very low due to high fuel moisture conditions and availability of water at time of burning. In addition, the channel length downstream of units that is forested, unmanaged, and having hyporheic interaction is substantial to promote cooling before reaching the McKenzie River. Therefore, the probability of affecting stream temperature through fuels treatment is **discountable**.

<u>Indicator Summary:</u>
The Project Design Criteria and TMDL Sufficiency Criteria were developed to protect stream temperature and ensure that sufficient shade will remain for perennial streams in the Bridge Thin action area. Stream shade may be slightly affected at the site scale initially with construction of yarding corridors and with implementation of fuels treatment. However, given the shade protection buffers, the spatial separation of the individual project activities from one another and LFH, the low stream flows in the perennial streams potentially affected and hydrologic disconnection between these streams and LFH, any negative effects to stream temperature would be **discountable**.

	Baseline Condition	
Suspended Sediment/Turbidity	Action Area	HUC6
	FAR	FAR
Substrate Embeddedness	Action Area	HUC6
	FAR	FAR

To evaluate the effects of the proposed action on sediment delivery, an annual sediment budget was prepared by Dave Kretzing, McKenzie River District Hydrologist. Quantitative rates of sediment delivery were calculated for surface erosion associated with existing road related sediment delivery and sedimentation delivery associated with culvert removal, road reconstruction, road decommissioning and increased road use for timber haul (Table 32).

Timber felling and yarding sediment effects were analyzed qualitatively based on findings by Rashin et. al. (2006). Rashin's research examined the effectiveness of equipment setbacks, stream buffers, falling and yarding practices, and harvest timing in reducing transport of sediment to small order streams. The study includes sites in western Washington, with west Cascades geomorphic conditions similar to those found in the Bridge Thin project area.

Roadway erosion was evaluated using a modeling tool to complete the analysis. Roads within the sub-watersheds were placed into 4 categories for analysis: Paved, Lower Slope, Mid Slope, and Ridge top, and mileages of each category were estimated based on map review. The Road WEPP module of the FSWEPP model was used to estimate sediment yields for each category of road. Several runs for each category were completed to account for differing levels of use and maintenance condition. The results were used to analyze existing condition, sediment yield while sale operations are in progress, and post sale conditions. Sediment yield was estimated for all roads in the project area, regardless of land ownership.

Table 32 summarizes the results of analytical procedures for the proposed action. Sources are displayed for National Forest System lands only. Volumes described are displaced or mobilized fine sediments from road use, and these values provide an estimate of overall soil disturbance, which is only partially correlated to soil delivery to stream channels.

Table 32. Sediment Yield Summary from Road Use for Bridge Thin Proposed Action

Sediment Source	No Action	Proposed Action	Proposed Action (Post-implementation)
NF Road Origin Sedimentation	247 cubic yards/year	273 cubic yards/year	229 cubic yards/year
Actual Increase from No Action	NA	+26 cubic yards/year	-18 cubic yards/year
% Change from No Action	NA	+ 10.5%	-7.3%

In the proposed action, sediment yields of road origin increase during project implementation, at a rate of approximately 26 cubic yards per year. Road reconstruction, semi-permanent road construction, timber harvest and timber haul is estimated to span about 3 years for various timber sales associated with Bridge Thin project. Sediment yield from roadway erosion is expected to decrease compared to the no action alternative once all project elements are complete (reflecting road condition improvement associated with maintenance/improvement and a lower level of use).

In addition to the annual sediment yield, culvert replacements will result in the greatest source of short-term sediment delivery, described below (Road Reconstruction project element), estimated at a one-time impulse of about 14.5 cubic yards (about 0.5 cubic yards per culvert – 26 replacements and 3 removals from decommissioning). It is important to note that the proposed culvert replacements/removals will result in stabilization of approximately 3,625 cubic yards of existing at-risk fill material. Modeled increase in sediment yield is expressed as a percent increase/decrease from the no action alternative for the proposed action in Table 32.

Effects of the Action by project element:

1) Timber Falling

a) Proximity: Within the primary shade zone, trees will be felled toward channels and left in place to construct yarding corridors (units described in Table 33). Otherwise trees will be fallen away from channels, toward yarding equipment and landing sites. Six of 38 corridors over intermittent waterways are closer than 1 mile in proximity to LFH (one stream in Unit 36 is 2,800 feet to LFH) otherwise corridors over all waterways, perennial and intermittent, are greater than 1 mile away.

Table 33. Skyline Corridors Through Stream Buffers and Proximity to Listed Fish Habitat

Unit	Acres by Yarding System			Skyline Corridors Across Streams			
				Perennial		Intermittent	
	Ground	Skyline	Helicopter	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
2	103	14	9	0		2*	No Connection
11	0	31	0	10	7,600	10	tributary to perennial stream
12	0	14	0	11	6,900	3	tributary to perennial stream
36	0	34	0	0		6	2,800
40	20	5	0	9	6,200	0	
45	15	20	0	10	11,000	4	tributary to perennial stream
47	0	29	0	7	13,800	0	
51	0	18	0	2**	5,600	6**	tributary to perennial stream
82	0	26	0	6*	No Connection	0	
84	0	20	7	0		3*	No Connection
88	0	8	23	0		4*	No Connection
91	17	18	0	2*	No Connection	0	
841	0	22	0	0		0	
TOTAL	747	931	458	57		38	

* corridors over channel with no surface connection to the McKenzie River (LFH);
**corridors over channel upstream of Tokatee Golf Course and are tributary to a series of golf course ponds.

b) Probability: Due to small tree diameters and lack of movement once a corridor tree is felled into the channel to create a yarding corridor, the likelihood of sediment mobilization to LFH is low. Minimum stream buffer width of 30 feet on intermittent streams, equipment setback requirements, and directional falling requirements carry low likelihood providing sedimentation to stream channels (Rashin et. al 2006). Distance of timber harvest activity to LFH and in several cases, absence of surface connection between harvest activity and LFH further reduces risk of fine sediment transport to LFH. In addition, the area of effect of openings adjacent to channels for corridors is only 1.6 acres - 0.06% of the 2,531 riparian reserve acres on federal land in the 6th Field sub-watershed. Considering absence of movement of corridor fallen trees, the small area of effect, and the distant proximity to LFH, the probability of sediment transport to LFH from timber felling is **discountable**.

Element Summary: At the site level, there may be some transport of sediment when trees are felled near streams for skyline corridors. However, considering the absence of movement of corridor fallen trees, the small area of effect, and the distant proximity to LFH, the level of sediment transport to LFH from timber felling is immeasurable and therefore **discountable**.

2) Timber Yarding

a) Proximity: The proximity of each unit to LFH is described in Table 2. Most of the streams within units do not have surface connection with the McKenzie River (LFH). There are three tributaries with surface connection to LFH that have harvest units in the uplands. These channel lengths from the closest unit to the McKenzie River (LFH) are as follows:

- *Mill Creek:* Unit 49 = 6,200 feet; Unit 36 = 2,800 feet
- *Unnamed Tributary through Tokatee Golf Course*: Unit 51 = 5,700 feet
- *Tributary from Southwest Side of Project Area:* Unit 21= 900 feet; Unit 15 = 3,600 feet; Unit 12 = 6,900

b) Probability: Mitigation measures restrict the proximity that ground-based equipment can approach perennial channels (120 feet). Use of existing skid trails and designation of new trails is expected to minimize ground disturbance by ground-based equipment. Rashin's research indicated a high degree of effectiveness in reducing transport of sediment to small order streams when 10 meter equipment setbacks and 10 meter stream buffers are incorporated into Best Management Practices. Actual equipment setbacks included as mitigation in the Bridge project range from 15 meters (50 feet) for non-fish bearing intermittent streams, to 36 meters (120 feet) for fish bearing and perennial streams. This represents a setback width this is at a minimum 50% greater than those found effective at reducing sediment yield found by the Rashin research. Best Management Practices in addition to those recommended by Rashin are described in Table 13 (elements 5-14) and have been found effective at reducing sedimentation resulting from timber harvest activity. Due to the limited extent of stream adjacent area subject to ground-based harvest, and mitigation measures to minimize potential ground disturbance, the likelihood of soil mobilization and alteration of listed species habitat is very low. Skyline yarding presents some increased potential, but due to small tree diameter and at least partial suspension, the likelihood of soil mobilization with skyline yarding is low. Helicopter yarding also presents a low risk of soil disturbance.

The presence of ground-based equipment presents minor increased risk of mobilization of sediment at the site-scale. Mitigations minimize potential negative effects with restrictions on equipment type and proximity to channels. Full suspension requirements while yarding over perennial channels will minimize potential mobilization of sediment. Where yarding occurs over intermittent channels and full suspension is not possible, mitigations will require yarding over dry channels only, including yarding over trees fallen into the channel to create a corridor.

The three tributary drainages (with harvest units) to the McKenzie River (LFH) all pass through a wide, porous glacial terrace before entering the McKenzie River. These lower reaches serve as depositional reaches, not transport reaches, and therefore provide opportunity for sediment to settle out before reaching the McKenzie River.

At the site scale there may be some sediment transport to streams. However, due to mitigation measures, hydrologic disconnection and distant proximity to LFH, stream channel length and complexity below units, and presence of a glacial terrace to facilitate sediment deposition, the probability of transporting sediment to LFH is near zero and therefore **discountable**.

Element Summary: At the site-scale, in the upland units, there may be a slight, short-term negative effect. However, due to the hydrologic disconnection and distant proximity to LFH, stream channel length and complexity below units, and presence of a glacial terrace to facilitate sediment deposition, the probability of transporting sediment to LFH is immeasureable. Therefore, timber yarding will have a **discountable** effect on the sediment indicators.

3) Timber and Rock Hauling

a) Proximity: Timber haul with closest proximity to LFH occurs largely along Hwy 126 (paved), Road 1900 near the South Fork McKenzie River (paved) and Road 1900-408 (aggregate surface, 1,400 feet to LFH, Table 6). Timber haul within 0.5 mile of LFH in the South Fork McKenzie sub-watershed consists of 925 truck loads crossing Pond Creek on Rd 1900-408 (east) to lower South Fork McKenzie River. Paved approaches and a paved crossing of the South Fork McKenzie River itself occurs on lower South Fork McKenzie River and over LFH. This road is paved for about 0.5 miles on one side of the bridge and for miles on the other. The same 925 loads would cross the South Fork McKenzie at this point (river mile 2.3).

Approximately 2,119 loads would cross Quartz Creek Bridge on Rd 1900-408, heading west (Table 6), immediately adjacent to LFH. This bridge is paved for at least 500' on one side, and paved to Hwy 126 on the other, with a paved crossing.

b) Probability: Road origin sediment yield is distributed across the landscape and is dependant upon road surface type, location and intensity of road use. The total volume mobilized due to timber haul (approximately 26 cubic yards per year of haul) will not all reach stream channels. A significant portion will be stabilized in vegetation (through ditch relief culverts) or into channels with no surface connection to the McKenzie River. The volume of sediment mobilized into stream channels with direct surface connection to the McKenzie River is dependant upon ditch length, adjacent vegetation and road surface area immediately tributary at each stream crossing. Aggregate surface haul routes with close proximity to LFH are on Rd 1900-408 (east) Pond Creek crossing 1,400 feet upstream of LFH. Ditch length and potential road surface contribution to Pond Creek total 100 feet of road. This small surface area is estimated to yield about .008 cubic yards of mobilized fine sediment per year, delivered to perennial Pond Creek downstream of the crossing. The low volume of fine sediment delivered at this crossing is not expected to arrive in LFH/CH in measurable quantity or present risk to LFH/CH (due to small volume, distance and channel storage). The Road 1900-408 (west) crossing of McKenzie River has paved approaches on both sides of the river. The north approach is entirely paved with connection to Hwy 126. The south approach is 500 feet of pavement, sloping away from the river before turning to aggregate. Well vegetated ditch lines act to stabilize sediments adjacent to aggregate surfaces. Observation of this area during haul from Quartz Creek drainage (Rosboro Lumber Co; including wet weather haul) yields fines to vegetated surfaces between the road and river, with no apparent overland flow or sedimentation to LFH. Aerially delivered dust to surrounding vegetation adjacent to Pond Creek and Quartz Creek bridge is probable with timber haul, but at levels discountable (due to watering mitigations; Table 13, measure 4). The overall probability of sediment reaching LFH is low.

c) Magnitude: The quantity of fine sediment delivered will be of small volume (a fraction of the estimated 26 cubic yards mobilized over 36 miles of haul route), delivered consistently during the haul period. A small increase in sediment yield associated with timber hauling and road work is anticipated, with net sediment yield a slight increase over background levels. Volumes of fine sediment delivered to LFH is believed not measurable at tributary junctions to LFH. There is a short-term negative influence presented by project haul activity (compared to no activity), but at an **insignificant** level. Project mitigations, including watering of road surfaces during dry periods of haul, are expected to reduce sedimentation.

Element Summary: A short-term negative effect is expected to occur with timber haul activity. The magnitude of effect, however, will be a slight increase over background levels, transmitted during the season of haul. The severity of effect is expected to be **insignificant** and is not expected to exceed listed species ability to utilize habitat or to cause avoidance of areas of local effect.

4a) Road Reconstruction, Culvert Replacement, Rock Pit Development and Road Decommissioning

a) Proximity: Habitat of importance to listed species could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity or during wet periods. However, the distance of culvert replacements at stream crossings with surface connection to LFH is no closer than 1 mile (Table 7). Similarly, the Mill Creek Rock Pit has no connection to nearest surface water (Mill Creek is over 1,000 feet away), and the pit is located 1.6 miles from LFH. A well vegetated buffer exists between potential overland routes and the rock pit.

b) Probability: It is not possible to do this work without some sediment displacement. A number of culverts will be replaced that are currently in poor repair or inadequately sized to pass Q100 flows. Replacement will require in-stream work in perennial crossings. Work will be done during non-flow periods for intermittent streams, and engineering practices such as sediment barriers and flow bypass will minimize impacts on perennial streams. The net effect of resurfacing activity is to simultaneously reduce road origin fine sediment while replacing undersized and aged culverts. The use of best management practices and mitigation measures to trap fine sediments during culvert replacement is expected to minimize impacts to aquatic habitat and resources, with a minor increase in sources of suspended sediment. Decommissioning of road surfaces and culvert removal will similarly be required to meet seasonal restrictions, limiting the transmission of fine sediment. Accurate estimates are not predictable, but depending on weather behavior and other variable factors, sediment yields should fall between 0.1 and 1.0 cubic yards per installation based on professional experience. Because some culverts to be replaced are in poor condition or undersized for Q100 flows, their current condition presents an elevated risk of failure.

Engineering personnel estimated average fill volume of 125 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culvert fails. Concurrent with culvert replacement will be resurfacing of the same haul routes, and an expected reduced rate of fine sediment transmission into waterways

c) Magnitude: Local disturbance and sediment delivery resulting from culvert replacements in the action area totals about 14.5 cubic yards – approximately 0.5 cubic yards per culvert (26 replacements and 3 removals for decommissioning). Pathways for increased sediment yield are advantageous on many tributaries to the McKenzie River and present negligible risk of affecting listed species habitat (few channels with surface connection to the McKenzie River). Those channels with direct connection to the McKenzie River (Mill Creek and a few unnamed tributaries) have limited potential to transmit sediment to listed species habitat due to: distance removed from LFH greater than 1 mile for surface connected channels; low gradient glacial terrace adjacent to the McKenzie River in the action area; channel complexity and storage capacity; and additional areas of sediment deposition such as golf course ponds and wetlands within the glacial terrace. Table 7 describes road crossing/culvert proximity and connectivity to LFH.

Mitigation methods to minimize mobilization and trap fines may be expected to reduce a portion of this amount. Beyond the short-term, a reduction in the rate of crossing failure is also likely following culvert replacements and can be expected to result in a further reduction in sediment yield. A fraction of the concentrations described above would be expected to be actually suspended, and are not expected to negatively effect listed species, or to incrementally increase background levels to a significant level to cause negative effects. Spring Chinook salmon in the vicinity of the McKenzie River/Elk Creek sub-watershed are known to use the area as spawning and rearing habitat, and bull trout as foraging habitat. Under conditions of a fall/winter first storm, both species are expected to exhibit avoidance behavior in response to turbid tributary conditions, and temporarily vacate turbid water (66-88 mg/l) (Newcombe and MacDonald 2001). Effects to spring Chinook spawning habitat located downstream of confluences, is also considered insignificant, due to the small volume of potential increase in the short-term.

The volume of fine sediment mobilized due to culvert replacement may be expected to have a slight negative effect on this indicator, but the quantity is considered **insignificant**. A longer term stabilization of stream crossings in the sub-watershed is expected to contribute to reduced rates of road generated sediment and mobilization of sediment for the life of the replacement culverts (~ 50 years). This reduction is expected to occur at an insignificant level (approximately 18 cubic yards/year).

Potential sediment flushes typically occur during the first fall/winter significant storm (> bankfull event or 1.5 year recurrence interval) and potential increases in road related reconstruction sediment yield would be expected at this point in time. Storm duration is usually several days long. Individual timber sales are expected to occur over a 3 year period, with associated road work in the vicinity of units occurring prior to thinning activity.

Element Summary: A short-term negative effect to this indicator, but **insignificant** in quantity of sediment mobilized during the seasons of culvert replacements and road reconstruction. Localized increases in turbidity during and following the season of culvert replacement, is believed to remain within the habitat needs of listed species.

4b) Semi-Permanent Road Construction

a) Proximity: Implementation of Bridge Thin project would require construction of 4.8 miles of semi-permanent road. Upon completion of sale activities, semi-permanent roads would be decommissioned and re-vegetated. With the exception of two stream crossings in Unit 2, no semi-permanent roads are located within riparian reserves (Figure A-8). Two intermittent channels are crossed by Unit 2 semi-permanent road. No surface connection to the McKenzie River is present in these crossings. During most flows, the tributaries crossed in Unit 2 go subsurface as they reach the McKenzie River glacial terrace, with no surface connection to the McKenzie River. At high flows, they flow into a series of ponds and wetlands at the base of the slope.

b) Probability: All semi-permanent roads to be constructed are situated on stable terrain and, with the exception of Unit 2, are outside of riparian reserves. These conditions make transport of sediment from disturbed soils unlikely and of low risk, and consequently no measurable amount of sediment is expected to reach stream channels as a result of road construction activity. Probability of negative effects is low. The intensity and severity of this activity are reduced with seasonal (dry season) restrictions on semi-permanent road construction and road decommissioning activities. Erosion control features at the two stream crossings and culvert removal points will be necessary. With mitigation measures in place, the probability of effect is **discountable**.

Element Summary: The low probability of mobilized sediment from semi-permanent road construction results in a **discountable** level of negative effect.

5) Fuels Treatment

Proximity: Fire prescriptions are just outside the primary shade zone of perennial and intermittent waterways tributary to LFH, to well upland - 0.2 mile or greater (individual unit proximity to LFH is described in Table 2). Oak savannah fire treatment Units 84, 85, and 86 have no surface connection to the McKenzie River (located 1,200 feet from the river or further). Fuel treatment buffers on channels are 60 feet from perennial and fish-bearing channels; 30 feet from intermittent channels.

Probability: Fire treatment prescriptions are focused on burning during periods of low risk, when spring-like conditions are present, and potential to carry into the crown and damage to duff layers is low. No units are prescribed for regeneration harvest and broadcast burn will not be used. Due to the immediate proximity of rural properties, a cautious use of fire in fuels treatment is prescribed. Burning activity will occur during spring-like conditions when soil and duff moistures are high enough to avoid loss of duff and mobilization of soil (desired burn intensity is low to conserve soil resources). Minimal fire backing into riparian reserves is expected in fire treatment stands due to site conditions (unit aspects and moist season burning). Fire line will not be dug within riparian reserves. With no construction of fire line in riparian reserves and low risk burning, the probability of effects will be **discountable.**

Element Summary: A **discountable** negative effect upon sedimentation/substrate embeddedness from fire treatments is expected.

Indicator Summary:

A very small portion of project generated fine sediment will reach the McKenzie River due to absence of surface hydrological connection across stable glacial terraces, floodplain landforms and soils. Several project elements have short-term negative effects upon the indicator of sedimentation to aquatic habitat. Cumulatively, these project elements do not add significant quantities of sediment beyond the “no-action” level of sediment yield (existing background levels) to place listed species or their habitat at risk. Short-term and localized increases in the rate of sedimentation delivered throughout project activities are considered an **insignificant** quantity that will not harm bull trout, spring Chinook, or their habitat.

Chemicals/Nutrients	Baseline Condition	
	Action Area	HUC6
	PF	PF

1) Timber Felling, 2) Timber Yarding, 3) Timber and Rock Hauling, 4) Road, Rock Pit and Landing Work, 5) Fuels Treatment

a) Proximity: A variety of project elements could occur between 30 and 300 feet from live streams with some hauling occurring directly over LFH and some road maintenance and reconstruction occurring upstream of LFH.

b) Probability: Although each of the project elements utilize petroleum based fuel, standard protection measures have been shown effective at reducing the probability of water contamination. Long-term monitoring of accidental spillage and contamination rates during similar projects implemented on the Willamette N.F. indicate that these types of events occur very infrequently. Therefore, the probability of a chemical contamination is **discountable**.

Risk of transmission of ignition fuels (gel fuels used to ignite slash piles) to waterways is discountable due to the long distance slash piles are located from channels. Increased nutrient supply to channels is greatest in underburn units (up to 1,514 acres) in which fire is allowed to back down into no-treatment buffers. Increased quantities of nitrate and phosphate may be available to the channel. However the small area of effect, location of burn beyond the riparian reserve, and rare occurrence of natural fire with fire suppression, reduce potential increases in nutrients to aquatic habitat to less than available within the historic fire regime. With precautionary measures in place to keep fire intensity and severity low near stream channels, the probability of affecting nutrient concentration is **discountable**.

<u>Indicator Summary</u>

Potential contaminants used with project implementation are not likely to enter the stream network. Risk of transmission of ignition fuels to stream channels is discountable. Potential increases in nutrients due to fire backing down into the no-treatment buffers will not be more than what was available within the historic fire regime. Therefore, there may be a slight negative but **discountable** effect on the indicator.

Physical Barriers	Baseline Condition	
	Action Area	HUC6
	PF	PF

<u>Indicator Summary:</u>

All elements have no causal mechanism to affect this indicator; they will have a **neutral** effect.

Indicator	Baseline Condition	
	Action Area	HUC6
Large Woody Material	PF	PF
Pool Frequency and Quality	NPF	NPF
Large Pools	NPF	NPF
Off-Channel Habitat	FAR	FAR
Refugia	NPF	NPF
Ave. Wetted Width/Max. Depth Ratio (in scour pools)	NPF	NPF
Streambank Condition	FAR	FAR
Floodplain Connectivity	NPF	NPF

The indicators listed above are grouped in the effects analysis because they are interrelated and effects realized by the stream indicators are primarily affected by changes to the large woody material indicator. Therefore, the effects analysis will focus on the project effect on the delivery potential and supply of large woody material.

a) Proximity: A variety of project elements occur between 30 and 300 feet from perennial streams with some hauling occurring directly over LFH and some road maintenance and reconstruction occurring upstream of LFH, with some potential to affect habitat conditions. There are no harvest units adjacent to LFH. Timber harvest Unit 23, the closest of the project units to the McKenzie River, is an overland distance of 490 feet (Table 2). All trees will be retained within the Stream Influence Zone along LFH.

1) Timber Felling

b) Probability: Timber falling has the greatest potential to influence aquatic habitat condition and influence the indicators described above, due to the removal of woody material mass and reduction of recruitment potential. As described in the riparian reserve indicator section, there is a very small likelihood of diminished in-stream wood supply from acres of riparian reserve thinned (Table 2), in part due to the small diameter of stem currently present, tree height, and the small area of thinning within the 100 foot zone adjacent to tributary channels. Removal of wood mass would influence future wood supply (immediately adjacent to tributary channels, generally within 100 feet) for a period estimated at 40 years. Debris torrents and material migrating to the McKenzie River channel are not a prevalent habitat forming processes in this 6th field sub-watershed. Rather, contribution to mainstem McKenzie River habitats is stream adjacent recruitment. There are no commercial thinning activities adjacent in the proposed action adjacent to the McKenzie River. The probability riparian reserve thinning would negatively affect habitat building, sediment storage capacity or floodplain processes in LFH is very low. An accelerated rate of stem development and tree height in even-aged stands is expected to contribute a greater diversity of significant sized LWD (>24 inch DBH), but the small overall area of treatment in riparian reserves is not expected to contribute significantly to future in-stream wood quantity in LFH for the same reason.

As described in Table 2, approximately 344 acres of riparian reserve (out of 492 acres) within project units would have thinning or fuels treatment activity. No harvest buffers (Table 1) will maintain trees immediately adjacent to channels for short, mid, and long term recruitment. However, thinning in the remainder of the riparian reserve could cause short term reductions in wood delivery to stream channels within proposed timber harvest units. These effects on tributary streams to LFH (the McKenzie River) are not expected to be negative for the following reasons:

- Many of the streams do not have surface connection to the McKenzie River. This is due to the porous and permeable nature of the glacial fill in the McKenzie River valley. Valley fills have been drilled to 146 feet in the Blue River area, and 175 feet in the McKenzie Bridge area (Williamson 1961 as cited in the Upper McKenzie Watershed Analysis 1995).

- Only 344 acres of riparian reserve out of 2,531 acres (13.6%) of riparian reserve on federal land in the 6th field sub-watershed would have thinning or fuels treatment activity, and this activity will not remove any trees from the streamside direct recruitment zones.

- There are 3 streams where timber harvest would occur in riparian reserves that do have a surface connection, but there is significant stream length on each of these tributaries that would not have any timber harvest (on federal lands). These areas of “no harvest” would provide a range of conditions to the riparian reserve system in this 6th field:
    - Mill Creek has approximately 5.1 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-5).
    - An unnamed tributary that flows through the golf course has approximately 2.5 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-5).
    - An unnamed tributary on the south side of the McKenzie River and the eastern portion of the project area has approximately 2.0 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-4).
- The mechanism for woody material to reach LFH in this 6th field is not due to debris flows that transport wood. Woody material in this 6th field comes from two sources: bank-side sources along the McKenzie River, and fluvial transport from sources further upstream in the river system (e.g. Deer Creek, and Horse Creek). Trees that fall into tributary

streams in this 6th field tend to stay where they fell, or if transported downstream for any distance will settle on the glacial terrace before reaching LFH (the McKenzie River).

c) Magnitude: Due to the relatively small portion of 6th field sub-watershed riparian reserve (on federal land) thinned -13.6% -, the minimal probability to influence current in-stream wood density with significant wood, and the amount of stream length that will have no timber harvest, the magnitude of project effect as a primary habitat forming component is **insignificant**. There is a slight negative effect on immediately available supply to tributary streams as described earlier, but this is not expected to translate into a negative effect on habitat indicators in LFH. A slight positive effect is expected in the future as the recruitment supply attains the desired diameters exceeding 24 inches (>40 years), and those trees function to store sediments and contribute to habitat formation. That level of benefit is expected at the site scale and is seen to benefit native species such as cutthroat trout and brook lamprey using tributary channels for some portion of their life history.

Element(s) Summary: Project design is intended to contribute large tree diameters to stream adjacent stands that have been previously managed. There is a current under-abundance of trees measuring greater than 24 inches in diameter in the sub-watershed that reflects past management effects upon riparian reserve composition. Acceleration of even-aged riparian reserve at this point in time is not expected to influence currently available significant wood, nor the immediate volume of in-stream wood.

Riparian thinning is not expected to result in negative effects to LFH given the following rationale: many of the tributary streams do not have a surface connection due to the porous and permeable nature of the glacial valley fills; only 13.6% of the riparian reserve on federal land within the 6th field sub-watershed have thinning or fuels treatment activities; there are approximately 9.6 miles of stream channel in the 6th field sub-watershed that will not have any thinning activity; and down woody material in tributary channels are highly unlikely to reach LFH. For these reasons, the slight negative effects due to riparian thinning on listed species habitat are expected to be of **insignificant** magnitude**.**

2) Timber Yarding and 3) Timber and Rock Hauling

There is no causal mechanism for these elements to affect the above indicators.

4) Road, Rock Pit and Landing Work, 5) Fuels Treatment

b) Probability: Other project elements have causal mechanisms limited by landscape processes to affect these indicators. Road reconstruction, culvert replacement, rock pit development and fuels treatment may have a slight negative effect of **insignificant** magnitude to these indicators as influenced by the Sediment indicator and described in the Sediment/Substrate Embeddedness effects discussion (for example, pool quality as affected by increased sediment supply would occur at a discountable level – i.e., the level of pool filling from increased fine sediment would be negligible).

Indicator Summary:

The slight **negative** effects to habitat indicators from removal of woody material are **insignificant** in magnitude. The probability of affecting the habitat indicators from road reconstruction, culvert replacement, rock pit development and fuels treatment is considered **discountable**. Other project elements will have a **neutral** effect on these indicators.

Change in Peak/Base Flows	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

1) Timber Falling, 2) Timber Yarding:

a) Proximity: Timber felling and yarding will occur up to 60 feet from perennial channels, but over 0.5 mile from LFH.

b) Probability: Effects of proposed harvest activities could be expected to be greatest immediately after implementation. Timber removal in the Bridge Thin Project is anticipated to be completed by 2012.The probability of affecting peak and base flow throughout the watershed with these project elements is low.

c) Magnitude: Timber felling changes the rate of evapotranspiration, increasing soil water and overall water yield. A short term (5-10 years) increase in discharge during the wet and the dry periods would occur from two mechanisms for the thinned stands. Increased snow accumulation (wet period) would create small increases in peak flows (Jones and Grant 1996), and reduced canopy (dry periods) would reduce transpiration rates which would account for small increases in summer flows.

Land Resource Management Plan (LRMP or Forest Plan) direction recommends midpoint levels of recovered forest condition (closed canopy conditions of stands generally greater than 15 years old). Midpoint values are determined by site conditions and beneficial uses. In the proposed action, post implementation recovery levels drop from 88.31% to 88.26% when compared to the No Action alternative (Table 34). All planning sub-watersheds continue to exceed recommended Midpoint values in the LRMP. Movement of the ARP (% recovered) value toward the midpoint indicates a slightly negative effect, but of **insignificant** magnitude.

Table 34. Recovery Levels (ARP) Immediately after Project Implementation in the McKenzie River/Elk Creek Sub-watershed.

	ARP Value
Forest Plan MidPoint Standard	80%
No Action	88.31%
Proposed Action	88.26%

*ARP values are constantly recovering as previously harvested stands of trees grow and regain their hydrologic function. The values reported are the expected condition at a point in time 3 years from present, when projects will be in the midst of completion.

Element Summary: There is insignificant probability and magnitude of affecting the above indicators - ARP levels are well above midpoint values. There will be a slightly negative but **insignificant** effect to flow regimes from timber felling and yarding in the Bridge Thin Project area.

3) Timber and Rock Hauling

a) Proximity: Drafting of water for dust abatement will occur in six potential established drafting sites (outside of LFH) shown in Figure A-11. Four of the sites are located at Blue River Reservoir, and two sites are located in upper Mill Creek – 9,400 feet and 13,800 feet from LFH.

b) Probability: Drafting of water from Blue River Reservoir will have no effect on peak/base flows. Drafting from upper Mill Creek may occur during base flows, but will maintain 90% of the stream flow at all times. Mill Creek's flow near the confluence with the McKenzie River was 9.8 cfs on June 24, 1993. The mean monthly flow for the McKenzie just above Mill Creek in June is 2,510 cfs (USGS, 2004-2006). At that time of year – about the same time drafting would occur for dust abatement – Mill Creek has approximately 0.4% flow contribution to the McKenzie River. The probability of drafting having an effect on peak/base flows in the McKenzie River is considered **discountable**.

Element Summary: Because drafting will occur from a regulated reservoir and from a tributary with minimal flow contribution to LFH, and will maintain 90% of flow in the channel, the probability of affecting peak/base flows in the McKenzie River is **discountable**.

4) Road, Rock Pit and Landing Work

a) Proximity: Landing work will occur as close as 700 feet from LFH and road work will occur as close as 200 feet from LFH. Approximately 4.8 miles of semi-permanent road will be constructed in the action area.

b) Probability: No semi-permanent roads will enter riparian reserves, except for one road that crosses two intermittent streams with no surface connection to LFH (Unit 2; Figure A-8). These crossings will require surfacing or drainage features. The semi-permanent roads will exist for the season of timber harvest, then will be obliterated upon completion of harvest activity (may exceed 1 year). Compacted soil at landings and roads may increase water yield due to reduced soil storage potential.

c) Magnitude: Approximately 30 acres of new landing work will be affected in the action area. This element will only affect 0.1% of the sub-watershed. This will result in a near zero magnitude of effect, far below any detectible level. Road work such as ditch cleaning, ditch relief culverts and decommissioning will help increase infiltration and would not have a negative effect. The negative effect of road and landing work on the indicator will be **insignificant**.

Decommissioning 0.3 miles of road and removing three stream crossings in the sub-watershed may be expected to contribute to improvement of the flow regime, as well as ripping of historic skid roads. This would result in a slightly positive effect, but at an **insignificant** level.

Element Summary: An increase in road surface through semi-permanent road construction is expected to lead to a greater efficiency in the drainage network for a short-term, but at an insignificant level. A longer term improvement through reduction in road surface (0.3 miles) is expected to be insignificant as well. The slight negative effect from this project element is **insignificant** in magnitude and presents no risk to listed species or habitat.

5) Fuels Treatment

a) Proximity: Underburning will occur up to 30 feet from perennial streams and up to 60 feet from LFH. Underburning adjacent to LFH, however, will be buffered by paved roads (see discussion below.)

Drafting of water for fuels treatment will occur in six potential established drafting sites (outside of LFH) shown in Figure A-11. Four of the sites are located at Blue River Reservoir, and two sites are located in upper Mill Creek – 9,400 feet and 13,800 feet from LFH.

b) Probability: Underburning can cause creation of hydrophobic soils, where soil structure is damaged, water storage potential is reduced, and yield increased. The amount of acres proposed for underburning is approximately 7.3% of available acreage in the McKenzie River/Elk Creek HUC6 watershed. Based on past experience and monitoring of underburn projects, we estimate that the actual acreage that burned hot enough to adversely affect infiltration and result in runoff will be less than 1% (Shank and Kretzing, pers. com.). This barely exceeds enough disturbance to predict a change in over-ground water flow. Because acreage being burned is within thinned stands, the intensity of the fire will be minor and not all soil conditions will lose their ability to withhold water. Since APR levels would be well above midpoint, the probability of underburning having an effect on peak/base flows is **discountable**.

Drafting for fuels treatment will occur during spring-like conditions, when flows are well above base flow. Drafting water from Blue River Reservoir will have no effect on peak/base flows. Drafting from upper Mill Creek will maintain 90% of the stream flow at all times. Mill Creek's flow near the confluence with the McKenzie River was 9.8 cfs on June 24, 1993. The mean annual flow for the McKenzie in June is 2,510 cfs. At that time of year Mill Creek has approximately 0.4% flow contribution to the McKenzie River. Due to the miniscule contribution of Mill Creek, the probability of drafting having an effect on peak/base flows in the McKenzie River is considered **discountable**.

Element Summary: The small amount of acreage being treated with low intensity fire barely exceeds enough disturbance to predict a change in over-ground water flow. The ARP levels will stay well above the midpoint value. Maintaining 90% flow when drafting from Mill Creek will not measurably effect peak/base flows in the McKenzie River. Therefore, the effect on the indicator is considered **discountable**.

<u>Indicator Summary:</u>

Post implementation recovery levels (ARP) drop from 88.31% to 88.26% when compared to the No Action alternative, and are well above the midpoint value (80%). An increase in road surface through semi-permanent road construction (4.8 miles) is expected to lead to a greater efficiency in the drainage network for a short-term, but at an insignificant level. A longer term improvement through reduction in road surface (0.3 miles) is expected to be insignificant as well. The small amount of acreage being treated with low intensity fire, and even smaller area that will burn hot enough to affect soil infiltration, is not enough to measurably affect over-ground water flow. In addition, drafting for dust abatement and fuels treatment will not measurable affect peak/base flows in the McKenzie. Cumulatively, there may be a slight negative but **insignificant** effect on peak/base flows.

Drainage Network Increase	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

1) Timber Felling, 2) Timber Yarding, 3) Timber and Rock Hauling and 5) Fuels Treatment

These project elements do not have any causal mechanism to affect these indicators, therefore it is concluded that their implementation would result in a **neutral** effect.

4) Road, Rock Pit and Landing Work

a) Proximity: Approximately 35 miles of road reconstruction and maintenance and 4.8 miles of semi-permanent road construction will occur upland of LFH. New roads and landings will not be constructed within riparian reserves, except one semi-permanent road over two intermittent streams crossings. There is no surface connection from these streams to LFH. Numerous ditch relief culverts will be installed and 26 culverts will be replaced in the action area along the haul route (Table 7).

b) Probability: This work may result in a slight change in the drainage network.

c) Magnitude: Culvert replacements and new installs, combined with road-blading (restoring road crown) and aggregate surfacing may be expected to have an **insignificant** positive effect on the drainage network, as replacements are expected to decrease the probability of road failure and new placements and road treatments are expected to improve dispersal of road concentrated flow onto the forest floor.

New semi-permanent road construction will result in a short-term increase in road density and drainage network, so there will be an **insignificant** negative effect to this indicator for short duration (1-3 years).

Road decommissioning of 0.3 miles of existing road will have a long-term, positive effect to this indicator.

Element Summary: Cumulatively, the effects to drainage network will be result in a **insignificant** change in the condition of this indicator, due to the small level of effect in the sub-watershed.

Indicator Summary:

Timber felling and yarding, timber and rock hauling, and fuels treatment have no causal mechanisms to affect the drainage network indicator. Road reconstruction and maintenance is expected to slightly improve the drainage network by decreasing the probability of road failure improving the dispersal of road concentrated flow onto the forest floor. This positive effect, however, is insignificant when compared to the overall drainage network of the sub-watershed. There is very small potential to favorably influence drainage network through decommissioning of 0.3 miles of existing road. Cumulatively, the project elements will have an **insignificant** affect on the indicators.

C. Project Effects to Watershed Condition Indicators (WCI)

Per AP direction, the watershed condition indicators would not be evaluated using the eight factors or by project element. Instead, this BA would provide information about changes to WCI values/conditions as a result of the entire action.

ROAD DENSITY AND LOCATION	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action - Indicator Summary:

This project will not construct any new permanent roads and semi-permanent roads used for yarding and log haul would be fully decommissioned after project implementation. A total of 0.3 miles of existing road will be fully decommissioned and removed permanently off of the road system. An additional 0.5 miles of road will be closed to access and hydrologically stabilized. The project will generate short term negative effects by increasing road density with semi-permanent roads, however this project will provide long term positive effects by decreasing road network and reducing the probability of road failure that would have an effect on aquatic resources and LFH. The effects would be **insignificant** due to the relative size of the McKenzie River/Elk Creek 6th Field sub-watershed.

DISTURBANCE HISTORY	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action - Indicator Summary:

ARP values would not be significantly altered within the McKenzie River/Elk Creek 6th Field sub-watershed (Table 34). The ARP values will stay well above midpoint following completion of the project suggesting that harvest would not affect the hydrological functioning of these drainage basins. Consequently, no direct, indirect, or cumulative changes in flow regime are anticipated, and the negative effect to listed species habitat is **discountable.**

The resultant short term and long term effects on habitat indicators due to proposed actions in watershed disturbance condition is reflected in the effect discussions. It is not expected that there would be any additional or collective negative effects due to the change in this indicator, other then those identified in the non-WCI indicator assessments. This indicator would have an **insignificant negative** effect from the project in the short-term. However, as LSR conditions improve, the sub-watershed will experience an **insignificant positive** effect.

RIPARIAN RESERVES	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Approximately 50% of federally managed land in the Elk/McKenzie River sub-watershed has been subject to timber management or road construction since 1930's. Project objectives include restoring a greater diversity (varying age and structural stages) of potential recruitment wood in the sub-watershed. Most of the project area is located within previously managed timber stands and consists of thinning 32-80 year old plantations (Table 18). The remainder of privately owned and managed land is largely of a young age (industrial timberlands managed on an approximate 40 year rotation) and/or developed as private or rural residential property. Only 344 acres of riparian reserve (13.6%) out of 2,531 acres of riparian reserve on federal land in the 6th field sub-watershed would have thinning or fuels treatment activity.

The desired benefit of thinning in riparian reserves is the influence on stand structure and the development of large diameter trees. The even-age character of managed stands ranging in age from 32-80 years, is expected to respond favorably to thinning in terms of growth rate. Once thinned, riparian reserve stands are expected to provide a greater degree of diversity of size in the long-term within the Elk/McKenzie River watershed as compared to non-thinning of reserves.

Plantation trees thinned in project area riparian reserves are expected to accelerate stream adjacent trees toward diameters considered better suited to provide stable in-stream large woody material. Within 40 years, stream adjacent trees thinned in this project, will begin to approach the size considered “significant” (greater than or equal to 24 inches in diameter at breast height) to function as in-stream sediment storage elements and valuable in aquatic habitat development. The future rate of wood recruitment to channels following thinning will depend largely upon natural disturbance events such as wind-throw and snow-down, flood, and fire. The current thinning proposal will be the last entry into these reserves under forest plan direction.

Portions of the riparian reserve that remain un-thinned are within 60 feet of perennial channels. That portion of the reserve will remain unmodified by the proposed action, and dependant upon natural disturbance processes for wood recruitment. The exceptions are openings created by skyline corridors in Unit 51 (over a fish-bearing channel) and Units 11, 12, 40, 45, 47, 51, 82, and 91 (non fish-bearing perennial channels) described in Table 33. Along skyline corridors some release of plantation trees would occur and be expected to accelerate tree growth. Trees yarded through skyline corridors will require full suspension over perennial waterways. Channels adjacent to skyline corridors will receive a management induced pulse of in-stream wood that will be left in place.

As this landscape rarely transports the products of disturbance, recruited material has little opportunity to migrate to listed fish habitat. Improvements in riparian stand diversity are expected to be of greatest benefit to resident fish, primarily cutthroat trout and brook lamprey.

Due to project area of riparian reserve treatment (13.6% of riparian reserve area in federally managed Elk/McKenzie sub-watershed), the influence over the long term on stand structure and future large wood recruitment will be minor on the 6th field scale. A short-term reduction in woody material recruitment supply will follow removal of thinned trees, generally within 60-100 feet proximity of perennial channels. Over the longer term, site specific benefits are expected to provide for a greater diversity of woody material available to aquatic habitat. Aquatic habitats currently characterized as simplified may be expected to improve in substrate storage and habitat complexity, improving their ability to meet aquatic life history needs at the site scale.

A short-term **negative** effect to this indicator is expected in the Elk Creek/McKenzie sub-watershed, due to a reduction in stream adjacent recruitment potential of woody material. A longer-term **positive** effect is expected as riparian stand diversity and diameters increase. Due to the low probability recruited material will migrate, the short and long term effects are **insignificant** to listed species habitat.

Fire prescriptions range from just beyond the primary shade zone of perennial and intermittent waterways tributary to listed species habitat, to well upland; 0.2 mile or greater. Fire treatment prescriptions are focused on burning during periods of low risk, when spring-like conditions are present, and potential to carry into the crown is low. No units are prescribed for regeneration harvest and broadcast burn will not be used. Due to the immediate proximity of rural properties, a cautious use of fire in fuels treatment is prescribed. Burning activity will occur during spring-like conditions when soil and duff moistures are high. Minimal fire creeping into riparian reserves is expected in fire treatment stands due to site conditions (unit aspects and moist season burning). Fire line will not be dug within riparian reserves.

Due to the low intensity of fire used and relatively small area treated by understory burning, there is a low level of effect of fuel treatment upon this indicator. Understory burning and treatment of management-induced fuel loads are proposed. Due to the timing of fire use, a **discountable** effect upon riparian reserve stand composition is expected.

Indicator Summary: Timber falling has short-term, **insignificant negative** effects upon the indicator of riparian reserves (also see discussion on large woody material indicator), but all other project elements will have **discountable** effects. All project elements combined do not reduce significant quantities of wood recruitment supply to listed fish habitat (beyond the "no-action" condition of wood recruitment supply) to place listed species or their habitat at risk. A reduction of recruitment supply through project activities is considered **insignificant** to listed fish habitat due to landscape transport processes.

DISTURBANCE REGIME (NATURAL PROCESSES)	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action: Indicator Summary:

This project would have a short-term negative effect of insignificant magnitude on this indicator at the action area scale. There would be no change to the vegetation class, rather a moderate thinning of an overstocked Douglas-fir stand to a stand more likely to reach large tree seral class more quickly. In the short-term, there will be a negative effect realized to LFH by increased sediment that is insignificant at the site scale level within the McKenzie River/ Elk Creek 6th Field sub-watershed. Longer term, this project would have a positive effect, as the remaining trees mature and road condition is improved. At the larger Quartz Creek HUC5 watershed, the limited extent of this project would not result in a measurable shift in the overall condition for the basin. Hence, the project would have an **insignificant** effect, both **positive and negative** to the disturbance regime indicator.

D. Project Elements and Effects Occurring Outside the McKenzie River/Elk Creek 6th field Sub-watershed:

South Fork McKenzie/Cougar Creek 6th Field portion of 3) Timber and Rock Haul

a) Proximity*: Timber haul in proximity to spring Chinook and bull trout Critical Habitat in the South Fork McKenzie sub-watershed consists of 925 truck loads crossing an unnamed tributary to lower South Fork McKenzie River on an aggregate surface. Proximity to listed fish habitat is 1,400 feet from this crossing. Paved approaches and a paved crossing of the South Fork McKenzie River itself occurs on lower South Fork McKenzie River and over Critical Habitat. The same 925 loads would cross the South Fork McKenzie at this point (river mile 2.3).

b) Probability: Delivery of road origin fine sediment would be expected at the unnamed tributary crossing. No measurable quantity of fine sediment would be expected at the paved crossing or from paved Rd 1900. Aerially delivered dust to surrounding vegetation adjacent to the unnamed tributary is probable with timber haul in the South Fork McKenzie River sub-watershed. The probability of these project elements having a negative effect on the suspended sediment indicator is low.

c) Magnitude: The quantity of fine sediment delivered will be of small volume, delivered consistently during the haul period. Project mitigations, including watering of road surfaces during dry periods of haul, are expected to reduce dusting at the unnamed tributary crossing. The magnitude of effects will be **insignificant**.

Element Summary: A slight negative impact to the suspended sediment indicator is expected in the South Fork McKenzie sub-watershed (slight increase over background levels), due to the proximity of Rd 1900-408 to the South Fork McKenzie, but **insignificant** in terms of quantity or potential negative impact to listed species or their habitat. The magnitude of effect in the South Fork McKenzie is similar to project hauling effects elsewhere in the project area (McKenzie River/Elk Creek 6th field sub-watershed), which were also considered **insignificant**.

McKenzie Bridge 6th Field portion of 1) Timber Felling and 2) Timber Yarding

a) Proximity: A small portion of unit 54 is located in McKenzie Bridge 6th field watershed (3.5 acres). No portion of the unit is located within riparian reserve. Proximity to listed fish habitat is 0.7 mile.

b) Probability: No surface connection to the McKenzie River is available from the nearest intermittent channel, so there is minimal chance for transport of sediment generated by ground disturbance to the McKenzie River. Therefore, probability of negative effects to listed fish or LFH is **discountable.**

Element Summary: No portion of Unit 54 is within riparian reserve and the nearest stream has no surface connection to LFH. Therefore, probability of effects to listed fish and LFH is **discountable**.

E. Project Effects to Population Indicators for Bull Trout

The AP directs the assessment of population indicators when recovery plans are available for listed species. For this project, a draft recovery plan for Columbia River bull trout is currently in use. The effects to population indicators (population size and distribution, growth and survival, life history diversity and isolation, and persistence and genetic integrity) are analyzed below.

POPULATION SIZE AND DISTRIBUTION:
Implementation of Bridge Thin project is not expected to result in bull trout take. Project and cumulative effect to bull trout or their habitat is judged **insignificant**. In the absence of significant direct, indirect or cumulative impacts to water quality and habitat, bull trout population and distribution is expected to be maintained. Improving diversity and quality (diameter) in riparian plantation stands is expected to contribute to improved stand composition in the 6th field. However, minimal opportunity for significant sized large woody material migration into bull trout habitat exists in this sub-watershed (and to positively affect habitat, population and distribution).

GROWTH AND SURVIVAL:
Project related effects to habitat in the McKenzie River are either **discountable** or **insignificant**. Potential effects to bull trout foraging and migration habitat are similarly of discountable probability. The bull trout life stages present adjacent to the project area would not be negatively affected in terms of growth and survival. Bull trout utilization of McKenzie River/Elk Creek sub-watershed is expected to continue unaltered.

LIFE HISTORY DIVERSITY AND ISOLATION:
The Bridge Thin project would have **no effect** on migration avenues, water quality or habitat to place bull trout life history needs at risk.

PERSISTENCE AND GENETIC INTEGRITY:
Although the mainstem McKenzie River bull trout sub-population is at elevated risk for loss of genetic variation, there is no causal mechanism for the proposed action to affect these indicators. As no project level effect to habitat or watershed indicators could lead to the reduction of bull trout population size, there is **no effect** to bull trout genetic persistence and integrity.

F. Project Effects to Primary Constituent Elements (PCEs) of Upper Willamette River Spring Chinook Salmon Critical Habitat

Only PCEs 1-3 are found within the 6th field sub-watershed. Existing condition of these PCEs is described baseline conditions:

Freshwater Spawning Sites:

Potential project influence on spring Chinook salmon spawning habitat is described in Substrate effects discussion. Fine sediment yield, primarily from culvert replacement, road work, timber yarding and timber haul do not add sufficient quantities to negatively affect spawning habitat. The rationale for considering sediment delivered of insignificant quantity is due to: 1) the low density of surface water connection directly to the McKenzie River along much of the project area; 2) distance of ground disturbing activity from Critical Habitat; and 3) with the exception of culvert replacement, absence of concentrated areas of disturbance (generally non-point supply of fine sediment). Risk of Bridge Thin project negatively affecting Spring Chinook spawning habitat or Chinook spawning survival is **insignificant**.

Freshwater Rearing Sites:

Potential project influence on spring Chinook rearing habitat is described in Habitat Indicator effects, and exists primarily through the potential to influence habitat quality through woody material supply. Project potential exists in the removal of woody mass, of potential benefit to in-stream habitat condition. Timber thinning activities are not expected to negatively affect rearing habitat by the following rationale: 1) the low density of woody material migration routes in the project area; 2) no project thinning of McKenzie River adjacent stands would occur; 3) the quality of potentially recruited trees is of low current value as an in-stream element, due to small diameter. The risk of Bridge thin project negatively affecting Spring Chinook rearing habitat is **discountable**.

Freshwater Migration Corridors:

As described above, the Bridge Thin project will not modify the quality or quantity of habitat contributing to migration corridors. The risk of Bridge Thin project negatively affecting Spring Chinook migration corridors is discountable.

G. Project Effects to Primary Constituent Elements (PCEs) of Columbia River Bull Trout Critical Habitat

Critical Habitat has been designated for Columbia River bull trout in the Willamette River basin (Final Rule September 26, 2005). This designation includes some river segments within the McKenzie River / Elk Creek 6th field sub-watershed (HUC). The USFWS has determined there are 8 primary constituent elements (PCEs) essential for the conservation of bull trout. These are sites and habitat components that support one or more life stages, including:

Water Temperature

- Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72^{o} F (0 to 22^{o} C) but are found more frequently in temperatures ranging from 36 to 59^{o} F (2 to 15^{o} C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and season variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout are specifically excluded from designation;

Summary: All trees within the primary shade zone will be left on site. The exception is trees needed to be felled for yarding corridors. Since the majority of streams on the landscape are intermittent or go subsurface before reaching the mainstem McKenzie River there would be **a negative effect of insignificant magnitude**.

Complex Stream Channel

- Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

Summary: As described in the factor analysis large woody material, off-channel habitat, large pools, and streambank condition there is a **discountable probability of negative effects** to attributes that comprise complex habitat features.

Substrate

- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. Should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

Summary: Road work, timber hauling, and road decommissioning have the potential deliver some small amounts of sediment to the mainstem McKenzie River. Since the majority of streams on the landscape are intermittent or go subsurface before reaching the mainstem McKenzie River there would be **a negative effect of insignificant magnitude**.

Hydrograph

- A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;

Summary: As described in the factor analysis project level effects are well above ARP mid-point thresholds. This project would primarily thin already managed stands and recovery is expected to occur shortly after project completion. Therefore project effects to the hydrograph in this subwatershed would be **short term negative effects of insignificant magnitude.**

Seeps, Springs and Groundwater Sources

- Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;

Summary: Springs, seeps, groundwater sources, and subsurface water would be protected by Best Management Practices and project design criteria. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible (Table 13). Therefore, the project should have **no effect** on these features.

Migratory Corridors

- Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;

Summary: As described in the environmental baseline, this project does would not create any migratory barriers for bull trout (either physical or thermal). Temperatures are well within limits for bull trout migratory needs and shade trees will remain on site. Therefore this project will have **no effect** on migratory corridors.

Food Base

- An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;

Summary: Samples that have been collected in this subwatershed have shown the macroinvertebrate community to have high biotic integrity. Shade and bank trees will be protected and this in turn will protect macroinvertebrate habitat. In addition road decommissioning should improve watershed conditions and provide for a reduction in sediment sources. However, since most streams are intermittent or go subsurface before reaching the McKenzie River the project would have a **positive effect of insignificant magnitude.**

Permanent Water Quality

- Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Summary: As described in the factor analysis changes in peak and base flows are possible but the effect would be insignificant. Best Management Practices and project design criteria would protect water features (streams, seeps, springs) on the landscape. Potential effects to bull trout reproduction, growth, and survival are unlikely and the **probability is discountable.**

VI. ESA EFFECTS DETERMINATION

The potential effects to spring Chinook salmon and bull trout using a habitat approach was discussed in detail in the previous chapter. The results of this analysis are summarized in Table 35. The AP provides a dichotomous key which is utilized to reach the appropriate ESA effect determination. Utilizing the indicator summaries from Chapter V and Table 36 of this document, the key provided an effect determination of Not Likely to Adversely Affect (NLAA) for spring Chinook salmon and bull trout as well as spring Chinook salmon Critical Habitat and bull trout Critical Habitat as shown in Table 36.

Table 35. Results of effects from project elements to habitat indicators.

Indicator	Action Area Baseline Condition	Element Summary					Indicator Summary
		Timber Felling	Timber Yarding	Timber Hauling	Road and Landing Work	Fuels Treatment	
Temperature	PF	-D	-D	N	-D	-D	-D
Suspended sediment - DO/turbidity	FAR	-D	-D	-I	-I	-D	-I
Chemical contamination/nutrients	PF	-D	-D	-D	-D	-D	-D
Physical barriers	PF	N	N	N	N	N	N
Substrate character/Embeddedness	FAR	-D	-D	-I	-I	-D	-I
LWD	PF	-I	N	N	-I	-I	-I
Pool Frequency and Quality	NPF	-I	N	N	-I	-I	-I
Large pools	NPF	-I	N	N	-I	-I	-I
Off-Channel Habitat	FAR	-I	N	N	-I	-I	-I
Refugia	NPF	-I	N	N	-I	-I	-I
Ave. Wetted Width/Depth Ratio(scour pools)	NPF	-I	N	N	-I	-I	-I
Streambank condition	FAR	-I	N	N	-I	-I	-I
Floodplain connectivity	NPF	-I	N	N	-I	-I	-I
Change in peak/base flows	NPF	-I	-I	-D	-I	-D	-I
Increase in drainage network	NPF	N	N	N	-I	N	-I
Road density and location	NPF						-/+I
Disturbance History	NPF						-/+I
Riparian Reserves	NPF						-/+I
Disturbance Regime	NPF						-/+I

Notes: - = Negative effect; + = Positive effect; N = Neutral effect. D = Discountable probability; I = Insignificant magnitude; -/+ = short-term negative effect, long-term positive effect

Table 36. AP Project Effects Determination Key For Species and Designated Critical Habitat

AP Project Effects Determination Key For Species and Designated Critical Habitat		
1) Do any of the indicators summaries have a positive or negative conclusion?		
	X	Yes - Go to 2
		No – No Effect
2) Are the indicator summary results only positive?		
		Yes – NLAA
	X	No – Go to 3
3) If any of the indicator summary results are negative, are the effects insignificant or discountable?		
	X	Yes – NLAA
		No – LAA, fill out Adverse Effects Form

This project was designed to minimize negative effects to water quality and ESA listed fish species, while still meeting the resource objectives associated with the project. This project is located in close proximity to habitat utilized by spring Chinook salmon and bull trout and therefore, land management projects are more likely to expose these fish to negative effects. The implementation of this project will not likely result in negative effects of measurable magnitude to any of the indicators. Direct take to spring Chinook salmon or bull trout is not believed to occur under implementation of any project element.

VII. AGGREGATED FEDERAL EFFECTS

The Army Corps of Engineers are proposing a trap-and-haul facility at the base of Cougar Dam, upstream of the McKenzie River/Elk Creek 6th field sub-watershed. When combined with the maintenance of listed species habitat with Bridge Thin project, improvements in spring Chinook returns and bull trout connectivity the South Fork McKenzie, may be expected to more fully utilize available habitat in the project 6th field sub-watershed. We are not aware of additional proposed federal actions for which a Biological Assessment has been submitted contemporaneously with this BA for ESA consultation, which would affect the ESA action area for this project. All ongoing actions with potential negative effects (where ESA consultation has been concluded), and effects of completed federal actions, are included in the environmental baseline for each indicator and have been considered in this analysis.

VIII. EFH ASSESSMENT

Essential Fish Habitat is present in the action area (and overlaps spring Chinook salmon Critical Habitat). Evaluation of effects to Critical Habitat are the same for Essential Fish Habitat. The Bridge Thin project “Will Not Adversely Affect” EFH due to only insignificant impacts generated by project elements. Insignificant effects are expected in the short term, during project implementation. See the above effects analysis to habitat elements for a detailed description.

IX. MONITORING OF EFFECTS

Monitoring of project effects will consist of implementation monitoring to insure Best Management Practices and mitigations are utilized as described in Table 13. Implementation is monitored by the timber sale administrator. Periodic visual monitoring by fisheries and watershed personnel will be used, particularly during the first fall and winter storms, of sediment mobilization and magnitude.

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File Code: 2670 **Date:** February 1 , 2008
Route To:

Subject: Biological Evaluation-Bridge Thin Project

To: Bridge Thin Team Leader/Analysis Files

I. Introduction

Purpose:
The purpose of this Biological Evaluation is to review the Bridge Thin project in sufficient detail as to determine whether the proposed action will result in a trend toward Federal listing of any sensitive botanical species.

Forest management activities that may impact populations of or alter habitat for PETS (proposed, endangered, threatened, or sensitive) species require a Biological Evaluation (FSM 2671.44) to be completed. The Biological Evaluation process (FSM 2672.43) is used to assist in determining the possible effects the proposed management activities have on:

A. Species listed or proposed to be listed as endangered (E) or threatened (T) by the U.S. Fish and Wildlife Service (FWS).

B. Species listed as sensitive (S) by the USDA Forest Service, Region 6. There are 73 plants listed on the Regional Forester's Sensitive Botanical List that are documented or suspected to occur on the Willamette National Forest (Attachment 1).

II. Description of the Proposed Project

Location:
The Bridge Thin Project area is within the McKenzie River / Elk Creek Subwatershed (6th field) of the McKenzie River/Quartz Creek Watershed (5th Field). The project area is 20,657 acres that lies East of the Finn Rock, and West of McKenzie Bridge.
Legal description of the project: Legal Locations: Within T.15S, R.4E, T.15S, R.5E, T.16S, R.4E, T.16S, R.5E; Willamette Meridian.; Lane County, Oregon.

Proposed Action:
The District Ranger on the McKenzie River Ranger District proposes to harvest timber on approximately 2,256 acres of the Bridge Thin Project Area, which would yield an approximate net estimate of 35.6 million board feet (MMBF) of wood products. This proposal, represented in Alternative B in the Bridge Thin Environmental Assessment, would include heavy thinning on 1,458 acres, moderate thinning on 398 acres, oak savanna restoration on 51 acres, wildlife forage thinning on 190 acres and fuels treatment on 178 acres. The timber sales from this proposal would likely occur over a four-year time span, beginning in fiscal year 2009.

III. Existing Environment and Survey Results

Regulatory Framework/Management Direction-Sensitive Plants/Rare and Uncommon Species
Forest Service Manual (FSM) 2670 direction is to ensure the viability of sensitive botanical species and to preclude actions that will contribute to the federal listing of a species. To ensure compliance with this direction, a biological evaluation is required for forest management activities that may alter habitat for proposed, endangered, threatened or sensitive species (*FSM 2671.44*) in order to determine the possible effects of the proposed activities on these species.

Amendment 158 to the Willamette Land and Resource Management Plan (USDA, 1990) adds four Conservation Strategies as amendments to the Forest Plan. The Conservation Strategies are for*: Aster gormanii, Ophioglossum pusillum, Cimicifuga elata and Frasera umpquaensis*. Conservation strategies include management plan and monitoring requirements as well as background material on status and distribution of the species.

Desired Future Condition-Sensitive Plants/Rare and Uncommon Botanical Species
The desired condition for Rare and Uncommon and sensitive botanical species is to maintain existing occurrences and to promote stand structure diversity and complexity that will provide more suitable potential habitat for many of these species in the future.

Sensitive/Rare and Uncommon Botanical Species:
Current management direction mandates conservation of several categories of rare plants on the Willamette National Forest (Attachment 1). The Endangered Species Act mandates protection of federally listed Threatened and Endangered species. No federally listed Threatened and Endangered, or Proposed plants occur in the project area. Sensitive species are protected by USDA Forest Service regulations and manual direction (FSM 2672.4).

Numerous sensitive plants on the Regional Forester's Sensitive Species list have potential to occur in the Bridge Thin project area, which encompasses a wide range of western Cascade forest habitats. Prefield reviews are conducted to determine which species from the Regional Forester's List for the Willamette National Forest are known from the project area or have suitable habitat present and potentially occur in the project area.

Prefield review for the Bridge Thin project indicated there are known populations of *Cimicifigua elata* and *Romanzoffia thompsonii* in the project area. (see Table 1).

Table 1. Sensitive Species in the Bridge Thin Project Area

Proposed Units	Sensitive Species	Buffer

Proposed Units	Sensitive Species	Buffer
2	*Cimicifuga elata*	180 ft.
86	*Romanzoffia thompsonii*	180 ft.
3, 26, 95	*Peltigera pacifica*	180 ft.
80, 95	*Usnea longissima*	180 ft.

Regulatory Framework/Management Direction-Special Habitats
Willamette National Forest Land and Resource Management Plan (USDA, 1990) has a provision "special wildlife and plat habitats not currently identified in non-harvest management areas shall be maintained. This should include the ecotone and a buffered area sufficient to maintain the microclimate of the site".

The Willamette National Forest Special Habitat Management Guide (Dimling and McCain, 1996) outlines habitat types and their importance to wildlife species, describes how to map habitats, and provides a methodology to delineate the buffer to maintain microclimate.

Desired Future Condition-Special Habitats

The desired future condition for special habitats is maintenance of the habitat through time. This may mean manipulating the stand to the edge of the habitat or buffering it from management activity.

Existing Condition-Special Habitats
Special habitats are non-forested habitats that are limited in size and distribution across the landscape. It is important to consider the biological diversity and ecosystem function of these small, scattered habitats for a number of reasons. Special habitats often play important roles for not only for full-time wildlife residents of the sites, but also for those who use them seasonally, or for only a portion of their life cycles. Numerous factors contribute to the creation or maintenance of special habitats. Among such factors, topography and hydrology often determine the microclimatic conditions at these sites.

More than twenty special habitats were located in the Bridge Thin project area during summer 2007 surveys. They range in size from one-half acre up to 6 acres. Sensitive plant populations also exist in or adjacent to four documented special habitats in the project area. The special habitats documented in the Bridge Thin project area and the buffer sizes recommended in the Willamette National Forest Special Habitat Management Guide are listed in Table 3.

Table 3. Special Habitats in the Bridge Thin Project Area

Proposed Units	Special Habitat	Buffer
26	Swamp	1 acre
95	Swamp	1 acre
95	Pond	1 acre
3	Pond	1 acre

Proposed Units	Special Habitat	Buffer
85	Dry meadow	NA- underburn proposed/exposure recommended
86	Dry meadow	NA-unit dropped
31	Dry meadow	180 ft.
32	Rock outcrop	180 ft.
32	Dry meadow	180 ft.
80	Dry meadow (Usnea site)	1 acre
35/36	Dry meadow	180 ft.
37	Dry meadow/rock outcrop openings	½ acre around cluster
33	Vine maple/rock outcrop	NA-unit dropped
6	Rock outcrop	180 ft.
29	Swamp	1 acre
105 *southern border, outside unit	Rock garden	NA-no effect expected, outside of unit
15	Rock outcrop	100 ft. around cluster
56	Rock outcrop and seep/wet meadow	180 ft.
11/ 12	Mesic meadow	180 ft.
43	Swamp/seep	180 ft. each
91	Swamp	1 acre

Regulatory Framework/Management Direction-Invasive Plants
Final EIS for Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants (*USDA Forest Service PNW Region, May, 2005*) amends the Willamette NF Land and Resource Management Plan and prescribes the need for prevention, inventory, early detection & rapid response on new populations, restoration of treatment sites and cooperation with other agencies and landowners.

Amendment 259 Willamette Land and Resource Management Plan (USDA, 1990) has four sections. It prescribes that prevention be integrated into all management activities; manual control may occur anywhere without additional environmental analysis; biological controls approved by USDA may be released on the Forest; a variety of control methods are available to treat weed infestations, depending on a site-specific analysis.

The Willamette National Forest *Integrated Weed Management Plan* (*IWMP 1999*) for managing invasive weeds states that each infestation of weeds will be managed according to its classification; new invaders will be eradicated using all control methods available and will have highest priority. Established infestations will be kept in check through biological and manual control methods. The last category, potential invaders, will be treated as new invaders if they are discovered on national forest lands. The following documents guide the treatment of competing and unwanted vegetation in the Pacific Northwest:

- Guide to Noxious Weed Prevention Practices (2001)
- Executive Order 13112 (February 3, 1999)
- Mediated Agreement (1988)
- Noxious Weed Control and Eradication Act (2004)
- Willamette National Forest Noxious Weed Prevention Guidelines (2005)

Desired Future Condition-Invasive Plants

The desired condition is prevention of new invader establishments and a cessation of established weed spread with a corresponding reduction in established weed presence. Allowing for the return of disturbed areas to a more natural condition helps retain sensitive species habitat and other special native habitats, and impedes noxious weeds from dominating these areas. This condition can be advanced through implementation of good management practices, minimizing disturbance where possible, and executing mitigation measures such as invasive weed removal and native species revegetation.

Existing Condition-Invasive Plants

Invasive plants on the Willamette National Forest are categorized as potential invaders, new invaders and established invaders and control strategies will differ, depending on species' classification.

- **Potential invaders** are those species located in adjacent National Forest or other lands that have a high probability of being detected on the Forest in the foreseeable future (next 15 years) because potential habitat exists here.
- **New invaders** are those weed species just entering the National Forest and whose populations are possible to eradicate.
- **Established infestations** include weed species that are so widespread on the Forest they are not likely to eradicate. Some species, such as blackberry, can have both new invader populations that are less than 10 plants and are outliers as well as established infestations such as those that are found bordering streams at lower elevations.

Several species of "new invader" plants are documented in the Bridge Stewardship project area. Some new invader species have greater potential to outcompete native plants and are more difficult to control than others, however all of them are capable of adverse ecological impacts. The new invader species known to occur in the Bridge Stewardship project area are listed below in Table 2:

- False brome (*Brachypodium sylvaticum*)-False brome is a perennial grass species of Eurasian origin. It has short bunches of bright green leaves that persist into fall and early winter. False brome can quickly become the dominant plant species in forest understories and in streamside corridors, demonstrating both shade-tolerance and moisture tolerance. Once established, false brome is spread by road maintenance equipment. From the road shoulder, the species can move into forested stands, especially those with openings such as thinned timber sale units. Seed is short-lived, so treatments for 3 years or less can exhaust the seed bank. Small populations may be manually controlled but large populations require herbicide application to eradicate because the populations, once established, can grow exponentially in short periods of time.

- Spotted knapweed (*Centaurea maculosa*)-Biennial or short-lived perennial with a stout taproot. Can have one or more stems, branched 1-3 feet tall. Produces purpleish-pink ray flowers. Introduced from Eurasia as contaminant of alfalfa and clover seed. Early spring growth makes spotted knapweed competitive for soil moisture and nutrients.

- Deadly nightshade (*Solanum dulcamara*)-A trailing or climbing perennial with spreading stems. Flowers are star-shaped with purple petals, and yellow or orange anthers. Native to Europe, but widely spread across North America. Typically found in moist waste areas, along fence rows, and drainage ditches and may form large thickets. All parts of the plant are toxic. The plants bright red berries seem to attract young children.

- Yellow toadflax (*Linaria vulgaris*)-Perennial, 1 to 2 feet tall, reproducing by seed and underground root stock. Flowers are 1 inch long with bearded, orange throat. Native of Eurasia, introduced to the United States in 1800's as an ornamental. Extensive root system makes control difficult.

- English ivy (*Hedra helix*)- English ivy is an evergreen climbing vine that attaches to the bark of trees, brickwork, and other surfaces by way of small rootlike structures which exude a sticky substance that helps the vines adhere to various surfaces. Older vines have been reported to reach 1 foot in diameter. Leaves are dark green with white veins, waxy to somewhat leathery, and arranged alternately along the stem. Leaf forms include a 3 to 5-lobed leaf (the most common) and an unlobed rounded leaf often found on mature plants in full sun that are ready to flower. Vines may grow for up to ten years before producing flowers. Under sufficient light conditions, terminal clusters of small, pale yellow-green flowers are produced in the fall. The flowers are attractive to flies and bees in search of late season nectar sources. The black-purple fruits have a thin fleshy outer covering, contain one to three hard, stone-like seeds and may persist through the winter if not eaten first.

- Field bindweed (*Convolvulus arvensis*)-Perennial with an extensive root system, often climbing for forming dense tangled mats. Leaves are more or less arrowhead-shaped, with white to pink trumpet-shaped flowers. This non-native was introduced from Europe and has become serious problem across most of the United States because of it is remarkably adaptable. Difficult to eradicate because roots may reach depths of 20 feet. Bindweed can be found at altitudes up to 10,000 ft. and produces seed viable up to 50 years.

- Deptford pink (*Dianthus armeria)* is a species of *Dianthus* ("pink") native to most f Europe, from Portugal north to southern Scotland and southern Finland, and east to Ukraine and the Caucasus. It is a herbaceous annual or biennial plant growing to 60 cm tall. The leaves are hairy, dark green, slender, up to 5 cm long. The flowers are 8–15 mm diameter, with five petals, bright reddish-pink; they are produced in small clusters at the top of the stems from early to late summer.

- Everlasting peavine (*Lathyrus latifolius*)-Perennial with broadly winged stems 2 to 7 feet long, and more or less climbing growth habit. Flowers are approximately 1 inch long, pink, red, or white. Native to Europe.

Table 2. Invasive Plants in the Bridge Thin Project Area

Invasive Species	Proposed Units	Recommended treatments (in addition to Ch. 2 mitigation measures, design criteria, and BMPs)
False brome (*Brachypodium sylvaticum*)	42, 43, 29-32, 26, 91, 3, 2, 19, 95	Mechanical Chemial
Spotted knapweed (*Centaurea maculosa*)	32, 9, 22, 71, 19, 6	Mechanical Chemial
Field Bindweed (*Convolvulus arvensis*)	43	Mechanical Chemical
Yellow toadflax (*Linaria vulgaris*)	40	Manual/Mechanical/Chemical
Deadly nightshade (*Solanum dulcamara*)	26, 95,	Mechanical Chemical
Everlasting peavine (*Lathyrus latifolius*)	91, 27, 102	Mechanical Chemical
English ivy (*Hedra helix*)	3	Manual/Mechanical/Chemical
Deptford pink (*Dianthus armeria.*)	68, 6, 103	Mechanical Chemial
* Evergreen blackberry (*Rubus laciniatus)*	82, 83,	Manual/Mechanical/Chemical

* Established species, but considered new invader population

Manual=hand pulling/digging before seed production

Mechanical=mowing/cutting just after flowering has ended, *but* before seed matures

Chemical=use of one or more herbicides approved for application in the Willamette National Forest Integrated Weed Management EA (March 2007)

Proposed actions may introduce or spread invasive and non-native plants. In most cases, the risk of worsening the Forest noxious weed problem can be minimized through proper inventory and project design. Implementation equipment and disturbance from yarding, road maintenance, and fuels treatments resulting from either alternative can provide an opportunity for invasive plants to establish and out-compete native vegetation.

Most noxious weeds are shade-intolerant so canopy closure can be particularly effective at minimizing weed establishment. Forest and Regional (USDA, 2004) policy recommends revegetation of disturbed sites with native species from *local genetic stock*.

Because the vast majority of the Forest's invasive plant infestations occur along road shoulders, road maintenance represents a particular risk for inadvertently spreading weeds.
Road maintenance activities across the Forest risk the spread of new invader species from one watershed to another. Activities such as grading, brushing and
mowing, culvert upgrades, and ditch cleaning can contribute to the spread of invasive plants along road corridors by transporting seeds from infested sites to uninfested areas.

To mitigate the spread of existing noxious weeds and reduce the risk of introducing other invasive species into the Bridge Stewardship project area, the following measures will be used:

- Off road or ground disturbing equipment will be washed prior to entering National Forest land. Equipment will be free of all seed and debris that may contain plant seeds such as soil and vegetation.

- Material brought in for construction, such as fill soil, gravel, and straw will be free of vegetative material and invasive plant seed.

- Monitoring for changes in existing populations or new occurrences of invasive plants in the project area.

- Retain barriers of undisturbed vegetation between weed infested areas and project areas.

- Treat existing infestations prior to project implementation to minimize seed spread.

- Clean equipment prior to coming on to the Forest and potentially between projects or sites, depending on the occupancy of weeds at the affected areas. Use appropriate clauses 154 to ensure contractors whose vehicles operate off the road surface are cleaning vehicles appropriately. See Appendix 1 for contract clauses (WO-C6.36 & WO-CT6.36).

- Work in weed-free areas prior to moving to weed-infested areas.

- Avoid putting landings, yarding stations, staging and equipment storage areas, in weed infested areas. Provide timber and other contractors with a map of infestations in the prework process. Weed infestations will be identified on the sale map.

- Revegetate site as soon as possible (during the appropriate planting or seeding window) following disturbance. Revegetation may include topsoil replacement, site prep such as ripping, planting, seeding, fertilizing and weed-fee mulching as necessary. Monitor sites and reseed or replant as necessary.

IV. Impacts of the Proposed Project

Alternative A: No-Action
Direct and Indirect Effects-Sensitive/Rare and Uncommon Species
This alternative would have no direct or indirect effect on sensitive plants or rare botanical species. There would be no ground-disturbance or disturbance of the microclimate with this alternative.

Selecting Alternative A may have potential adverse effects on certain species of sensitive fungi. Without management action, downed wood accumulation would likely increase over time. Landscapes with heavy fuel loads are at greater risk of high-intensity, stand replacing fires. As a result, high intensity fire is more likely to sterilize the soil, thus destroying fungal spores and mycelium found in organic mater on the surface and uppermost soil horizons.

There are established populations of invasive plants in the Bridge Thin project area, which are tolerant of closed canopy conditions and are capable of prolific growth. Alternative A indirectly poses a low risk of adverse effects to potential sensitive habitat occurring in the project area because it does not promote additional resources for shade-tolerant invasive plant species.

Alternative A: No-Action
Direct and Indirect Effects-Invasive Plants
Selecting this alternative would allow the same level of invasive plant control as currently programmed. New and potential invader plant populations documented in the Bridge Thin project area would remain highest priority in receiving treatment and monitoring.

The No-Action alternative would not provide an opportunity to further contain or control invasive plant populations, or reduce the current rate of spread of these species within the project area. This alternative does nothing to manage established new invader populations along forest Road 1900408 beyond those practices addressed in the Willamette National Forest Integrated Weed Management EA (March 2007).

Alternative A-No Action
Direct and Indirect Effects-Special habitats

Selecting the No-Action alternative would allow for the same level of special habitat management annually programmed. This alternative would have no adverse effect on special habitats.

Effects Common to Alternatives B and C
Direct and Indirect Effects-Sensitive/Rare and Uncommon Species
No direct or indirect effects on sensitive plants or rare botanical species are expected with either alternative. All known sensitive plant occurrences have been mapped and would be protected with a 180 ft. *no-disturbance* buffer to maintain the viability of the populations. The buffer would maintain the microclimate for those species requiring cover or moisture retention and aid in protecting other species from physical damage during project implementation. This buffer applies to all harvest activities, ground disturbing activities, and fuels treatments.

Cimicifuga and Romanzoffia are species often found associated with special habitats such as riparian areas, and steep, rocky seeps. These unique features are limited across the project area landscape. The main threats to these plants and habitats are disturbance and changes in hydrology. Of the respective action alternatives, Alternative C proposes the least thinning, particularly in riparian areas; therefore, potential adverse effects to Cimicifuga and Romanzoffia would be lowest with this alternative.

Peltigera and Usnea are lichens found in or associated with moist coniferous forests at low to mid elevations. The Peltigera sites in the Bridge Thin project area are on bare mineral soil and rock. The sites were located in units proposed for harvest, ground-based yarding, and fuels treatments. The likelihood of adverse effects on the Peltigera sites from the proposed actions is low with 180 ft. no-disturbance buffers.

Usnea substrate is alder and small diameter trees in the Bridge Thin project area. Directs effects may occur from torching during under burning or damage from other fuels treatments such as grapple or hand piling. Habitat fragmentation is a concern as well, because Usnea disperses mainly by thallus fragments, and occasionally by soredia. More so, Usnea is very sensitive to air pollution, and is at moderate risk of indirect impacts from residual smoke from fuels treatments (McCune & Geiser 1997). Alternative C poses the least risk of adverse effects to sensitive species because it proposes the least disturbance in suitable habitat.

Fungi are difficult to identify in the field, often requiring chemical and microscopic spore analysis. Apart from taxonomy, fungal relationships in ecosystems and seemingly sporadic fruiting from year to year add to the complexity of fully understanding these organisms. Indirectly, canopy removal would have the most impact fungi that are sensitive to microclimatic change. Subsequent slash pile/fuels treatments have potential to affect some fungi species in the Bridge Thin project area. Without knowing the presence or absence of these fungi, a reasonable assumption is that there may be some localized effects to them from timber felling, yarding and fuels treatments. However, these actions have a low risk of adverse effects to sensitive fungi and are not likely to cause a trend toward federal listing of a particular species.

Alternative B has the greatest risk of potential adverse effects to known sensitive plants or suitable habitat for those *potentially* occurring in the Bridge Thin project area because it proposes to harvest more acreage in potential habitat.

Cumulative Effects-Sensitive/Rare and Uncommon Species
The analysis area for sensitive and rare botanical species cumulative effects is the Bridge Thin Project area. There are no planned activities adjacent to the analysis area, therefore actions beyond this analysis area would have no effect on sensitive species, or other rare botanical species potentially located in the Bridge Thin analysis area.

Implementation of the proposed action or any action alternatives would not have measurable cumulative effects on sensitive plants in the project area because of the buffer and no-disturbance mitigation. Based on the analysis of this project there would be no incremental change to existing populations of sensitive species or other botanical species in the project area due to selecting any alternative detailed in the Bridge Thin EA.

Direct and Indirect Effects-Invasive Plants
Alternatives B and C both would have congruent direct impacts on invasive plants because both propose similar acres of harvest or fuel treatments and miles of road maintenance. The ground disturbance caused from implementation may provide suitable conditions for invasive plants to establish or out-compete native vegetation.

Most of the invasive plant populations in the Bridge Thin project area are established along roads and are mainly spread by vehicular traffic. However, false brome and English ivy occur in units proposed for harvest, ground-based yarding, and under-burning fuels treatments.

Without mitigation measures, selecting either of the alternatives would result in high risk of further spreading or introducing invasive plants. Without mitigation measures, the proposed actions would have a high risk of spreading invasive plants onto adjacent properties by hauling across ownership boundaries. However, the effect Alternative B would have on invasive species compared to Alternative C is not likely to contrast much because the difference in proposed road maintenance is approximately less than one mile.

Cumulative Effects-Invasive Plants
The cumulative effects analysis area for invasive plants is the entire Bridge Thin project area are associated with ground-disturbance activities and adjacent roads. This analysis addresses known distribution of invasive plants and likely travel routes for the proposed projects.

Past management activities in the last 50 years include road construction, road maintenance, and timber harvest. Included in these activities are the Eugene Water and Electric Board (EWEB) power line corridor and vegetation management activities. Because of the design criteria and mitigation measures, there is no expected increase of cumulative effects on invasive plants. The potential opportunities afforded by this project would provide additional resources to treat the new invader species in the Bridge Thin project area, and assist in reaching the goal of control and eventual eradication of *new* invader plants. This would result in an overall net improvement of invasive plants in the Bridge Thin project area.

With the exception of false brome and English ivy, most invasive plants found in the project area are shade-intolerant and generally confined to roadsides and open areas. Being sessile organisms, adaptations in pollination and seed dispersal are necessities of survival for plants. One of many ecological advantages of invasive or non-native plants is the lack of native competition to keep populations balanced. More so, prolific propagation and the ability to disperse large amounts of seed is probably the greatest advantage invasive plants have in native ecosystems.

Even without past or present management actions, invasive plants would still be present from natural and biological vectors. Invasive plants are present on the properties of adjacent landowners and along the Highway 126 corridor. However, past harvest and road maintenance activities within the Bridge Thin project area have provided additional opportunities for establishment and spread of invasive plants. Some management actions, such as harvest and yarding, result in short-term disturbance conducive for invasive plant establishment. The effects of these actions are greatest at the on-set of implementation and often decrease over time and with stand succession.

Other management activities like road construction or maintenance often result in longer-term effects to invasive plant infestations. This is because roads serve dual functions by acting as suitable ground for the establishment of invasive plants and by providing the plants access to a host of potential vectors.

Implementing any of the alternatives detailed in the Bridge Thin EA would have a non-measurable cumulative effect on invasive plants because both action alternatives propose to decommission 0.3 miles of road and the No-Action alternative proposes no road management all.

Direct and Indirect Effects-Special habitats

The action alternatives would have no direct or indirect impact on special habitats. Special habitats would also be buffered from harvest and ground disturbing activities. These buffers would maintain the microclimate, hydrology, and prevent damage to the areas during project implementation.

The main direct impacts to special habitats from the proposed actions are removal of overstory and ground disturbance. Without the 180 ft. buffer and no-disturbance mitigation, reduced cover could potentially decrease humidity and increase temperature earlier in the growing season, thus altering habitat viability.

By comparison, Alternative B proposes to harvest and treat fuels on more acres than Alternative C; therefore, it poses the higher risk of adverse impacts to special habitats in the Bridge Thin project area.

Cumulative Effects-Special Habitats

The analysis area for special habitat cumulative effects is the Bridge Thin Project area. This area was chosen because activities outside the analysis area would have no effect on special habitats located within the project analysis area.

Implementation of the proposed action or any action alternatives would not have measurable cumulative effects on sensitive plants in the project area because of the no-disturbance mitigation. Based on the analysis of this project there will be no incremental change to existing populations of special habitats in the project area as a result of selecting any alternative detailed in the Bridge Thin EA

V. Determination/Conclusion

Risk Determination-Sensitive Plants/Rare and Uncommon Species
It is my determination that implementation of this project will have "no impact" on sensitive botanical species known to occur in the Bridge Thin project area because of the no-disturbance buffers. Because of the no-disturbance buffer and mitigation, the likelihood of adverse effects to sensitive plants in the Bridge Thin project area is low.

For unknown fungi, implementation of this project "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species".

Risk Determination-Invasive Plants
The risk of adverse effects to invasive plants in the Bridge Thin project area is moderate with specific mitigation measures, design criteria, and best management practices. To mitigate the spread of existing invasive plants and reduce the risk of introducing other invasive species into the Bridge Thin project area, the following measures will be used:

- Off road or ground disturbing equipment will be washed prior to entering National Forest land. Equipment will be free of all seed and debris that may contain plant seeds such as soil and vegetation.

- Material brought in for construction, such as fill soil, gravel, and straw will be free of vegetative material and invasive plant seed.

- Monitoring for changes in existing populations or new occurrences of invasive plants in the project area.

- Retain barriers of undisturbed vegetation between weed infested areas and project areas.

- Treat existing infestations prior to project implementation to minimize seed spread.

- Clean equipment prior to coming on to the Forest and potentially between projects or sites, depending on the occupancy of weeds at the affected areas. Use appropriate clauses 154 to ensure contractors whose vehicles operate off the road surface are cleaning vehicles appropriately. See Appendix 1 for contract clauses (WO-C6.36 & WO-CT6.36).

- Work in weed-free areas prior to moving to weed-infested areas.

- Avoid putting landings, yarding stations, staging and equipment storage areas, in weed infested areas. Provide timber and other contractors with a map of infestations in the prework process. Weed infestations will be identified on the sale map.

- Revegetate site as soon as possible (during the appropriate planting or seeding window) following disturbance. Revegetation may include topsoil replacement, site prep such as ripping, planting, seeding, fertilizing and weed-fee mulching as necessary. Monitor sites and reseed or replant as necessary.

Risk Determination-Special Habitats
It is my determination there is a low to moderate risk of adverse impacts to special habitats in the Bridge Thin project area from proposed actions with the no-disturbance buffer and mitigation.

Unit	Risk Assessment	Connected Actions and Rationale	Mitigation Measures Relative to Unit (prior to implementation)
26	Moderate	-known sensitive sites -BRSY populations on adjacent roads -proposed fuels underburn on 15 acres	-avoid fuel treatments in sensitive plant locations -mechanical treatment of BRSY before seed matures -chemical treatment of BRSY later in growing season
32	Moderate	-existing BRSY and CEMA pop. in unit -proposed underburn on 123 acres	-mechanical treatments before seed matures -chemical treatments later in growing season
80 * Alt. B only	Moderate	-known sensitive sites -proposed fuels underburn on 10 acres -RUDI populations in unit	-cut canes and grub RUDI root crowns -avoid underburning fuels due to air quality issues with lichen
3	Low	-known sensitive sites -grapple or hand pile fuels -HEHE in unit, BRSY on adjacent road	-avoid disturbance to known sites -manual treatment of HEHE -mechanical

			treatment -chemical treatment
29	Low	-BRSY on adjacent road -underburn/grapple or hand pile fuels	-mechanical and chemical treatments of roadside populations
43	Low	-BRSY on adjacent road -underburn/grapple or hand pile fuels	-mechanical and chemical treatments of roadside populations
91 * Alt. B only	Low	-BRSY, HEHE, and LALA in unit and on adjacent road	-manual, mechanical, and chemical treatments

Prepared by: _/s/Burtchell Thomas______________ Date:_February 1 , 2008____
Burtchell Thomas, Botanist
McKenzie River Ranger District

Attachment 1: Summary of Potential Habitat and Presence for Sensitive Botanical Species

Species	**Prefield Review**	**Species Presence**
Agoseris elata	habitat present	No
Arabis hastatula	habitat not present	No
Arnica viscosa	habitat not present	No
Asplenium septentrionale	habitat not present	No
Aster gormanii	habitat not present	No
Boletus pulcherrimus	habitat present	No
Botrychium minganense	habitat present	No
Botrychium montanum	habitat present	No
Botrychium pumicola	habitat not present	No
Bridgeoporus nobillisimus	habitat not present	No
Calamagrostis breweri	habitat not present	No
Carex livida	habitat not present	No
Carex scirpoidea var. *stenochlaena*	habitat not present	No
Castilleja rupicola	habitat not present	No
Chaenotheca subroscida	habitat present	No
Cimicifuga elata	habitat present	Unit 2
Coptis trifolia	habitat present	No
Cordyceps capitata	habitat not present	No

Corydalis aqua-gelidae	habitat not present	No
Cortinarius barlowensis	habitat present	No
Cudonia monticola	habitat not present	No
Dermatocarpon luridum	habitat not present	No
Eucephalis(Aster) vialis	habitat present	No
Frasera umpquaensis	habitat not present	No
Gentiana newberryi	habitat not present	No
Gomphus kaufmanii	habitat present	No
Gyromitra californica	habitat present	No
Hypogymnia duplicata	habitat present	No
Iliamna latibracteata	habitat present	No
Leptogium burnetiae var. hirsutum	habitat present	No
Leptogium cyanescens	habitat present	No
Leucogaster citrinus	habitat present	No
Lewisia columbiana var. columbiana	habitat not present	No
Lobaria linita	habitat not present	No
Lupinus sulphureus var. kincaidii	habitat present	No
Lycopodiella inundata	habitat not present	No
Lycopodium complanatum	habitat not present	No
Montia howellii	habitat not present	No
Mycenia monticola	habitat not present	No
Nephroma occultum	habitat not present	No
Ophioglossum pusillum	habitat not present	No
Pannaria rubiginosa	habitat present	No
Pellaea andromedaefolia	habitat not present	No
Peltigera neckeri	habitat present	No
Peltigera pacifica	habitat present	Unit(s) 3, 26, and 95
Phaecollybia attenuata	habitat present	No
Phaeocollybia dissiliens	habitat present	No
Phaeocollybia pseudofestiva	habitat present	No
Phaeocollybia sipei	habitat present	No
Pilophorus nigricaulis	habitat not present	No
Polystichum californicum	habitat not present	No
Potentilla villosa	habitat not present	No
Pseudocyphellaria rainierensis	habitat present	No
Ramalina pollinaria	habitat present	No
Ramaria amyloidea	habitat present	No
Ramaria aurantiisiccescens	habitat present	No

Ramaria gelatinaurantia	habitat present	No
Ramaria largentii	habitat present	No
Rhizomnium nudum	habitat not present	No
Romanzoffia thompsonii	habitat present	Unit 86
Scheuchzeria palustris var. Americana	habitat not present	No
Schistostega pennata	habitat not present	No
Scouleria marginata	habitat not present	No
Sisyrinchium sarmentosum	habitat present	No
Sowerbyella rhenana	habitat not present	No
Tetraphis geniculata	habitat not present	No
Thorluna disimilis	habitat not present	No
Usnea longissima	habitat present	Unit(s) 80 and 95
Utricularia minor	habitat not present	No
Wolffia borealis	habitat not present	No
Wolffia columbiana	habitat not present	No

ATTACHMENT 2: **Regional Forester's Sensitive Botanical Species List for the Willamette National Forest FY 2007.** Species of federal, state and local importance are included on the R-6 list.

Species	Occurrence on WNF	ONHP Status	State Status	Federal Status	Habitat Types
Agoseris elata	S	2			MM,DM
Arabis hastatula	D	1		SofC	RO
Arnica viscosa	S	2			RS
Asplenium septentrionale	S	2			RO
Aster gormanii	D	1			RS
Boletus pulcherrimus	D	1			CF
Botrychium minganense	D	2			RZ,CF
Botrychium montanum	D	2			RZ,CF
Botrychium pumicola	S	1	LT		HV
Bridgeoporus nobilissimus	D	1			CF
Calamagrostis breweri	D	2			MM,RZ
Carex livida	S	2			WM
Carex scirpoidea var. stenochlaena	D	2			RO
Castilleja rupicola	D	2			RO
Chaenotheca subroscida	D	3			CF
Cimicifuga elata	D	1	C		CF
Coptis trifolia	S	2			WM,CF
Cordyceps capitata	D	unlisted			CF
Corydalis aqua-gelidae	D	1	C		RZ,CF
Cudonia monticola	D	not listed			CF
Dermatocarpon luridum	S	3			RZ on rock
Eucephalis (Aster) vialis	S	1	LT	SofC	CF
Frasera umpquaensis	D	1	C		MM
Gentiana newberryi	D	2			MM
Gomphus kaufmanii	D	3			CF
Gyromitra californica	D	2			CF
Hypogymnia duplicata	S	3			CF
Iliamna latibracteata	S	2			CF,RZ
Leptogium burnetiae var. hirsutum	S	3			CF
Leptogium cyanescens	D	3			CF
Leucogaster citrinus	D	3			CF
Lewisia columbiana var. columbiana	D	2			RS
Lobaria linita	D	2			RO
Lupinus sulphureus var. kincaidii	S	1	LT	LT	MM,DM
Lycopodiella inundata	D	2			WM
Lycopodium complanatum	D	2			CF

Occurrence ONHP State Federal Habitat

Species	on WNF	Status	Status	Status	Types
Montia howellii	D	4	C		RZ
Mycenia monticola	D	not listed			CF
Nephroma occultum	D	4			CF
Ophioglossum pusillum	D	2			WM
Pannaria rubiginosa	D	2			CF
Pellaea andromedaefolia	S	2			RO
Peltigera neckeri	D	not listed			CF
Peltigera pacifica	D	not listed			CF
Phaeocollybia attenuata	D	4			CF
P. dissiliens	D	3			CF
P. pseudofestiva	D	3			CF
P. sipei	D	3			CF
Pilophorus nigricaulis	D	2			RO
Polystichum californicum	D	2			RO
Potentilla villosa	D	2			RS, RO
Pseudocyphellaria rainierensis	D	4			CF,RZ
Ramalina pollinaria	D	2			CF, RZ
Ramaria amyloidea	D	2			CF
R. aurantiisiccescens	D	4			CF
R. gelatiniaurantia	D	3			CF
R. largentii	D	3			CF
Rhizomnium nudum	D	2			CF
Romanzoffia thompsonii	D	1			RS
Scheuchzeria palustris var. americana	D	2			WM
Schistostega pennata	D	2			CF
Scouleria marginata	S	3			RZ
Sisyrinchium sarmentosum	S	1	C	SofC	MM,DM
Sowerbyella rhenana	D	3			CF
Tetraphis geniculata	S	2			CF
Thorluna disimilis	D	2			CF
Usnea longissima	D	3			CF,RZ
Utricularia minor	D	2			SW
Wolffia borealis	S	2			SW
Wolffia columbiana	S	2			SW

Occurrence on Willamette National Forest:
S = Suspected
D = Documented

Oregon Natural Heritage Program (ORNHP):
1 = Taxa threatened or endangered throughout range.
2 = Taxa threatened or endangered in Oregon but more common or stable elsewhere.
3 = Species for which more information is needed before status can be determined, but which may be threatened or endangered (Review).
4 = Species of concern not currently threatened or endangered (Watch).

Oregon State Status:
LT = Threatened
LE = Endangered
C = Candidate

Federal Status: These plant species were originally published as CANDIDATE THREATENED (CT) in the Smithsonian Report, **Federal Register**, July 1, 1975, or as PROPOSED ENDANGERED (PE) in a later report, **Federal Register**, June 16, 1976. The latest **Federal Register** consulted was dated September 30, 1993. Updated listings appear periodically in the Notice of Review (USFWS); the status of several species is categorized as follows:
LE = Listed as an Endangered Species
LT = Listed as a Threatened Species
PE = Proposed as an Endangered Species
PT = Proposed as a Threatened Species
C = Candidate for Listing as Threatened or Endangered
Sof C = Species of Concern; taxa for which additional information is needed to support proposal to list under the ESA.

Habitat Types:

MM = Mesic meadows	RS = Rocky slopes, scree
WM = Wet meadows	RO = Rock outcrops, cliffs
DM = Dry meadows	DW = Dry open woods
RZ = Riparian zones, floodplains	HV = High volcanic areas
CF = Coniferous forest	SW = Standing water

ATTACHMENT 3: **Field reconnaissance survey levels for determining presence potential for TES species.**

Level A:	Aerial photo interpretation and review of existing site records. Determination of the potential for a listed species to occur within the proposed project area. No field surveys completed.		
	Low potential:	Less than 40% potential for listed species inhabiting the project area.	
	Moderate potential:	40-60% potential for a listed species inhabiting the proposed project area.	
	High potential:	Greater than 60% potential for listed species inhabiting the proposed project area.	
Level B:	Single entry survey of probable habitats. Areas are identified by photos and existing field knowledge. Field surveys are conducted during the season most favorable for species identification.		
	Low intensity:	Selected habitat surveys (approximately 5-10% of area) are conducted with a single entry for listed species inhabiting the proposed project area.	
	Moderate intensity:	Selected habitat surveys (approximately 10-40% of area) are conducted with a single entry for listed species inhabiting the proposed project area.	
	High intensity:	Selected habitat surveys (approximately 40-60% of area) are conducted with a single entry for listed species inhabiting the proposed project area.	
Level C:	Multiple entry surveys are conducted for listed species likely to inhabit the proposed project area.		
	Low intensity:	Selected habitat surveys (approximately 5-10% of area) are conducted with repeated entries for listed species inhabiting the proposed project area.	
	Moderate intensity:	Selected habitat surveys (approximately 10-60% of area) are conducted with	

	repeated entries for listed species inhabiting the proposed project area.
High intensity:	Selected habitat surveys (approximately 60-80% of area) are conducted with repeated entries for listed species inhabiting the proposed project area.

ATTACHMENT 4:

Conclusions Of Effects For Use In Biological Evaluations and Assessments

USDA Forest Service - Regions 1, 4, and 6

August, 1995

Listed Species:

1. No Effect

   Occurs when a project or activity will not have any "effect", on a listed species, or critical habitat.

2. May Affect - Likely to Adversely Affect (LAA)

   If the determination in the biological assessment is that the project May Affect - Likely to Adversely Affect a listed species or critical habitat, formal consultation must be initiated (50 CFR 402.12). Formal consultation must be requested in writing through the Forest Supervisor (FSM 2670.44) to the appropriate FWS Field Supervisor, or NOAA Fisheries office.

3. May Affect - Not Likely to Adversely Affect (NLAA)

   If it is determined in the biological assessment that there are "effects" to a listed species or critical habitat, but that those effects are not likely to adversely affect listed species or critical habitat, then written concurrence by the FWS or NOAA Fisheries is required to conclude informal consultation (50 CFR 402.13).

4. Beneficial Effect

   Written concurrence is also required from the FWS or NOAA Fisheries if a beneficial effect determination is made.

   Requests for written concurrence must be initiated in writing from the Forest Supervisor to the State Field Supervisor (FWS or NOAA).

Proposed Species:

Whenever serious adverse effects are predicted for a proposed species or proposed critical habitat, conferencing is required with the FWS or NOAA Fisheries.

1. No Effect

When there are “no effects” to proposed species, conferencing is not required with FWS or NOAA.

2. Not Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat

This conclusion is used where there are effects or cumulative effects, but where such effects would not have the consequence of losing key populations or adversely affecting “proposed critical habitat”. No conferencing is required with FWS or NOAA if this conclusion is made. However, for any proposed activity that would receive a “Likely To Adversely Affect” conclusion if the species were to be listed, conferencing may be initiated.

3. Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat

This conclusion must be determined if there are significant effects that could jeopardize the continued existence of the species, result in adverse modification or destruction of proposed critical habitat, and/or result in irreversible or irretrievable commitments of resources that could foreclose options to avoid jeopardy, should the species be listed. If this is the conclusion, conferencing with FWS or NMFS is required.

Sensitive Species:

1. No Impact (NI)

A determination of “No Impact” for sensitive species occurs when a project or activity will have no environmental effects on habitat, individuals, a population or a species.

2. May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (MIIH)

Activities or actions that have effects that are immeasurable, minor or are consistent with Conservation Strategies would receive this conclusion. For populations that are small - or vulnerable - each individual may be important for short and long-term viability.

3. Will Impact Individuals or Habitat With a Consequence That the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (WIFV)

Loss of individuals or habitat can be considered significant when the potential effect may be:

1. Contributing to a trend toward Federal listing (C-1 or C-2 species);
2. Results in a significantly increased risk of loss of viability for a species; or,
3. Results in a significantly increased risk of loss of viability for a significant population (stock).

4. Beneficial Impact (BI)

Projects or activities that are designed to benefit, or that measurably benefit a sensitive species should receive this conclusion.

ATTACHMENT 5:

Conclusions Of Effects For Use In Biological Evaluations and Assessments

USDA Forest Service - Regions 1, 4, and 6

August, 1995

Listed Species:

1. No Effect

Occurs when a project or activity will not have any "effect", on a listed species, or critical habitat.

2. May Affect - Likely to Adversely Affect (LAA)

If the determination in the biological assessment is that the project May Affect - Likely to Adversely Affect a listed species or critical habitat, formal consultation must be initiated (50 CFR 402.12). Formal consultation must be requested in writing through the Forest Supervisor (FSM 2670.44) to the appropriate FWS Field Supervisor, or NOAA Fisheries office.

3. May Affect - Not Likely to Adversely Affect (NLAA)

If it is determined in the biological assessment that there are "effects" to a listed species or critical habitat, but that those effects are not likely to adversely affect listed species or critical habitat, then written concurrence by the FWS or NOAA Fisheries is required to conclude informal consultation (50 CFR 402.13).

4. Beneficial Effect

Written concurrence is also required from the FWS or NOAA Fisheries if a beneficial effect determination is made.

Requests for written concurrence must be initiated in writing from the Forest Supervisor to the State Field Supervisor (FWS or NOAA).

Proposed Species:

Whenever serious adverse effects are predicted for a proposed species or proposed critical habitat, conferencing is required with the FWS or NOAA Fisheries.

1. No Effect

When there are "no effects" to proposed species, conferencing is not required with FWS or NOAA.

2. Not Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat

This conclusion is used where there are effects or cumulative effects, but where such effects would not have the consequence of losing key populations or adversely affecting “proposed critical habitat”. No conferencing is required with FWS or NOAA if this conclusion is made. However, for any proposed activity that would receive a “Likely To Adversely Affect” conclusion if the species were to be listed, conferencing may be initiated.

3. Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat

This conclusion must be determined if there are significant effects that could jeopardize the continued existence of the species, result in adverse modification or destruction of proposed critical habitat, and/or result in irreversible or irretrievable commitments of resources that could foreclose options to avoid jeopardy, should the species be listed. If this is the conclusion, conferencing with FWS or NMFS is required.

Sensitive Species:

1. No Impact (NI)

A determination of “No Impact” for sensitive species occurs when a project or activity will have no environmental effects on habitat, individuals, a population or a species.

2. May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (MIIH)

Activities or actions that have effects that are immeasurable, minor or are consistent with Conservation Strategies would receive this conclusion. For populations that are small - or vulnerable - each individual may be important for short and long-term viability.

3. Will Impact Individuals or Habitat With a Consequence That the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (WIFV)

Loss of individuals or habitat can be considered significant when the potential effect may be:

4. Contributing to a trend toward Federal listing (C-1 or C-2 species);
5. Results in a significantly increased risk of loss of viability for a species; or,
6. Results in a significantly increased risk of loss of viability for a significant population (stock).

4. Beneficial Impact (BI)

Projects or activities that are designed to benefit, or that measurably benefit a sensitive species should receive this conclusion.

Appendix D

Biological Assessment and Biological Evaluation, Wildlife

McKenzie River Ranger District

Biological Assessment for the Bridge Thin Project

January 10, 2008

I. Introduction

The McKenzie River Ranger District is requesting formal consultation for the proposed Bridge Thin Timber Sale project in Lane County.

This Biological Assessment was prepared pursuant to the Endangered Species Act of 1973, as amended (ESA), to describe and evaluate potential effects of the proposed action on the northern spotted owl (*Strix occidentalis caurina*). The proposed action complies with the Record of Decision and the Standards and Guidelines of the Northwest Forest Plan (USDA and USDI 1994a), as amended by the Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl (USDA and USDI 2004), and with the Land and Resource Management Plan for the Willamette National Forest.

The project was reviewed by the Terrestrial Level 1 Team on October 11, 2007.

A. Scope of the Assessment

The action area is the proposed project plus all federal and non-federal lands within 1.0 miles. This assessment describes and evaluates the potential affects of specific activities that would modify habitat, including critical habitat of the northern spotted owl. The assessment also evaluates disturbances associated with these activities within the distances shown in Table 1.

B. Definitions

For the purposes of this assessment, the following definitions are used.

Northern Spotted Owl

***Suitable habitat*:** Consists of stands used by owls for nesting, roosting and foraging. Generally these stands are conifer-dominated, 80 years old or older and multi-storied in structure, and have sufficient snags and downed wood to provide opportunities for owl nesting, roosting and foraging. The canopy closure generally exceeds 60 percent.

Dispersal habitat: Conifer and mixed mature conifer-alder habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average dbh. Generally, spotted owls use dispersal habitat to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat lacks the optimal structural characteristics needed for nesting.

Breeding Period: The breeding period for northern spotted owls is March 1 through September 30. The critical breeding period is March 1 through July 15.

Known Owl Site: A site that was or is occupied by a pair or resident single as defined by protocol (1990-2007). The specific site location is determined by the unit biologist based on the best and/or most recent information. A known site may be determined to be inactive only in accordance with the survey protocol.

Predicted Owl Site: An area able to support resident spotted owls (i.e. a potential breeding pair) as determined by the USFWS occupancy template (USFWS 2007). This is used for determining effects to spotted owls where survey data are insufficient.

Nest Patch (or Stand): 200 meters around a known or predicted owl site, where a spotted owl would be likely to select a nesting tree. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest.

***Core Area*:** 0.5 mile around a known or predicted owl site, which delineates the area most heavily used during the nesting season.

***Home Range*:** An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2 miles around a known or predicted owl site (Thomas et al. 1990).

C. Disturbance and Disruption Distances

Disturbance distance: the distance from the project boundary outward within which the action is likely to cause a northern spotted owl, if present, to be distracted from its normal activity. Except as stated Table 1, the disturbance distance is 0.25 mile from nesting spotted owls. The unit wildlife biologist may increase or decrease these disturbance distances according to the best available scientific information and site-specific conditions.

Disruption distance: the distance from the project boundary outward within which the action is likely to cause a northern spotted owl, if present, to be distracted to such an extent as to significantly disrupt its normal behavior and create the likelihood of harm or loss of reproduction. The disruption distance is a subset of the disturbance distance. Proposed activities that would occur within the distances shown in Table 1, of northern spotted owl might disrupt the normal behavior patterns of individual owls or breeding spotted owls. The unit wildlife biologist may increase or decrease these disturbance distances according to the best available scientific information and site-specific conditions.

D. Habitat Modification

<u>Maintained</u>: refers to silvicultural activities that alter forest stand characteristics but maintain the components of spotted owl habitat within the stand such that spotted owls can continue to have their life history requirements supported (ie. the functionality of the habitat used by spotted owls remains intact post silvicultural activity). For spotted owl dispersal-only habitat this means that a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post silvicultural activity to adequately provide for spotted owl dispersal. For spotted owl suitable habitat (also known as NRF[1]) a canopy cover of >60 percent along with other habitat elements (e.g. including snags, down wood, dominated by large overstory trees, tree-height class-diversity, and older hardwoods) will be maintained post silvicultural activity to adequately provide for spotted owl nesting, roosting, and foraging within the stand. The administrative unit biologist is responsible for ensuring that proposed silvicultural activities that are described as being in this category will maintain the characteristics of spotted owl suitable and dispersal habitat in affected stands for each site-specific action. In addition, in the case of suitable-maintained, the administrative unit biologist is responsible for assessing the juxtaposition[2] of the affected stand within the surrounding forest landscape to ensure that appropriate effects to spotted owls are documented.

[1] Nesting, roosting and forage habitat formally referred to as NRF.
[2] Site specific information may reveal a local concern for an owl pair that is relying on the harvest unit. An example: a spotted owl pair's home range contains sub optimal levels of foraging habitat that any impact, even when minor, may contribute to the inability of the spotted owl pair to support successful reproduction.

Available scientific literature provides support for the finding that forest stands can be altered in a manner that does not necessarily change the habitat function for spotted owls (e.g., Forsman et al. 1984, USFWS 2007a). Examples of silvicultural activities that may fall into this category are light to moderate thinning, down salvage, individual tree removal, and prescribed burning.

Downgrade: to change spotted owl suitable habitat to dispersal habitat.

Remove: Alter spotted owl suitable so that the habitat no longer supports nesting, roosting or foraging, and dispersal or alter spotted owl dispersal habitat so that the habitat no longer supports dispersal.

Table 1 Disturbance and disruption distances[1] for the northern spotted owl during the breeding period

Source of Disturbance/ Disruption	Disturbance Distance	Disruption Distance	
	Entire Breeding Period (March 1 – September 30)	**Critical Breeding Period** (March 1 – July 15)	**Late Breeding Period** (July 16 – September 30)
Blasting	1,760 yards (1 mile)	1,760 yards (1 mile)	440 yards (0.25 mile)
Burning	440 yards (0.25 mile)	440 yards (0.25 mile)	0 yards
Chainsaw use	440 yards (0.25 mile)	65 yards	0 yards
Hauling on open roads	0 yards	0 yards	0 yards
Heavy equipment	440 yards (0.25 mile)	35 yards	0 yards
Helicopter – Type I[2]	880 yards (0.5 mile)	440 yards (0.25 mile)	440 yards (0.25 mile)
Helicopter – other[3]	440 yards (0.25 mile)	120 yards	0 yards
Rock crushing	440 yards (0.25 mile)	180 yards	0 yards

[1] Noise distances were developed from a threshold of 92 dB (USFWS 2003). Smoke disturbance distances are based on a FWS white paper (USFWS 2007)

[2] Type I helicopters seat at least 16 people and have a minimum capacity of 5,000 lbs. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters.

Kmax helicopters are considered "other" for the purposes of disturbance. Sound readings from Kmax helicopter logging on the Olympic NF registered 86 dB at 150 yards (Piper 2006).

[3] All other helicopters (including Kmax)

II. Description of Proposed Action

Proposed Action

Table 2 describes the types of activities evaluated by this assessment and the conditions under which each activity may proceed and Table 3 and Table 4 shows activities within suitable and dispersal habitat for the proposed project. Together, these activities constitute the proposed action. All project units are in an Adaptive Management Area (AMA) allocation. Some units are within Critical Habitat Unit OR-16.

The proposed action includes all processes needed to plan, evaluate, survey, prepare and complete activities including, but not limited to, falling, bucking, hauling, post-harvest burning, and post-harvest firewood cutting. The existing rock quarry in Unit 41 will be used as rock source. The Bridge Thin project is expected to occur between fall of 2008 and fall 2011. No other actions are interrelated to or interdependent on the proposed action.

Table 1 Description of proposed habitat modification by activity type.

ACTIVITY TYPE	DESCRIPTION
ROCK QUARRY OPERATION	Blasting, crushing, and rock hauling would occur at the existing rock quarry in Unit 41. This rock quarry is not located in a CHU.
ROAD RECONSTRUCTION	Roads would be cleared of vegetation, restored to grade and surfaced as needed for log or rock hauling. Road reconstruction would occur inside and outside a CHU.
HEAVY THINNING OF DISPERSAL FOR BIG GAME FORAGE ENHANCEMENT	Heavy thinning would maintain a minimum of 30-50 percent average canopy closure throughout the stands. Functionality of dispersal habitat is temporarily reduced to non-habitat habitat. These fast growing trees are expected to recover to the 40% canopy closure within 7-10 years. No helicopters will be used for yarding on these treatment units. Unit of measure is acres thinned. These big game forage enhancement units are not located within a CHU.
LIGHT TO MODERATE THINNING IN DISPERSAL HABITAT	Light to moderate thinning is the partial removal of the overstory. Such thinning in dispersal habitat would maintain a minimum 60 percent average canopy cover throughout the stands. Unit of measure is acres thinned. Ten of these thinning units are located within a CHU.
REGENERATION HARVEST FOR SAVANNA RESTORATION	This activity restores a portion of the McKenzie River / Elk Creek 6th field watershed from the present closed canopy coniferous forest to a pre-settlement condition of open savanna with scattered Douglas-fir, Oregon white oak and a variably dense grass understory. Canopy cover is reduced below 30 percent. Unit of measure is acres treated. Helicopter use would occur on units 84 and 85. No savanna restoration units are located in a CHU.
HELICOPTER YARDING	It is assumed that a type I helicopter will be used to yard logs from the unit to the log landings on units 1,2,4,5,6,13-18,26,29-31,56,57,59,63,84, 85 and 88. Two helicopter units (57 and 63) are located in a CHU.
LOG AND ROCK HAUL	Log trucks would transport logs from the unit to the mill and rock trucks would transport rock to reconstruction sites. No hauling would occur within 35 yards of a known or predicted nest site. Some log and rock haul would occur in a CHU.
FUELS REDUCTION	Fuel reduction treatments can include burning and the shredding and chipping of small <7" diameter materials in dispersal habitat that maintains a canopy cover greater than 60 percent. No commercial harvest would occur. No fuels reduction units are in a CHU.
POST HARVEST BURNING	Treatment of harvest generated fuels can include grapple piling, hand piling and under burning.
FIREWOOD CUTTING	Firewood would be cut from decks placed during timber sale operations. Firewood cutting will occur once harvest is complete or the following season if timing does not permit.

Table 2 Proposed actions by activity in suitable habitat.

Activity	Acres*	NSO Habitat		Owl Home ranges within the Action Area						
		Current Condition	After Treatment	0029	0104	0856	2034	2422	2443	2836
Light/Mod Thin for Fuels Reduction (units 101 and103)	38	Suitable	Suitable	This fuels reduction activity is not within the home range of any known or predicted site.						

Table 4 Proposed actions by activity in dispersal habitat.

Activity	Acres* (Miles for Road Reconstruction)	NSO Habitat		Owl Home ranges within the Action Area						
		Current Condition	After Treatment	0029**	0104	0856	2034	2422**	2443	2836**
Road Reconstruction (in miles)	32	N/A	N/A	X	X	X	X	X	X	X
Heavy Thin for Big game Forage (40,42,43,44,45, 68,80)	237	Dispersal	Nonhabitat	X	X					X
Regen for Oak Savanna Restoration (84,85,86,87,89)	38 18	Dispersal Nonhabitat	Nonhabitat Nonhabitat							
Light/Mod Thin (all remaining units)	1774	Dispersal	Dispersal	X	X	X	X	X	X	X
Light/Mod Thin for Fuels Reduction (50,95,96,97,98, 99,100, 102)	140	Dispersal	Dispersal							X
* acres shown are total for activity and may fall completely or partially inside owl home range(s) and include post harvest burning and firewood cutting. ** Known owl site located in Critical Habitat Unit OR-16										

In addition to the descriptions and activity types in 2, the following standards are common to all proposed activities:

Standards

a. A wildlife biologist participated in the planning and design of all activities affecting listed species.
b. A known nest tree may be removed *only* when it is an immediate hazard *and* when the tree is unoccupied by nesting birds or their young. A 50 foot defensible space will be maintained around a historic nest tree for MSNO 2836 during post harvest burning.
c. Seasonal restrictions will be in place for burning activities on unit 60 and blasting at the rock quarry in unit 41 during the critical breeding season for spotted owls.
d. No activity that, in the opinion of the unit wildlife biologist, would remove spotted owl habitat in areas where the amount of post-activity habitat would be insufficient for owl dispersal is addressed by this assessment.
e. At the end of each calendar year, the McKenzie River Ranger District will complete a project implementation and monitoring form to show actual levels of adverse effects and actions that remove, downgrade or maintain spotted owl suitable habitat or remove dispersal habitat. This form should be forwarded to the Fish and Wildlife Service to fulfill the monitoring report requirements. Monitoring completes the regulatory requirements of the ESA by documenting the actual effects to the subject species.

   Monitoring will ensure that actual levels of adverse effect and incidental take, whether from habitat modification, associated disturbance or impacts to critical habitat, resulting from implementation of the proposed action, do not exceed the levels anticipated by this assessment. Before exceeding an anticipated level of incidental take or adverse effect, the administrative unit shall inform the Interagency Level 1 Team and re-initiate formal consultation with the Fish and Wildlife Service.
f. No activity that would remove or downgrade northern spotted owl habitat in an Area of Concern (AOC) is addressed by this assessment.

III. Environmental Baseline

Northern spotted owl

Legal Status

The spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USFWS 1990a). The Service recovery priority number for the spotted owl is 6C, on a scale of 1C (highest) to 18 (lowest) (USFWS 1983a, 1983b, 2004). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies. The "C" reflects conflict with development, construction, or other economic activity. The spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USFWS 2004).

Life History

Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, Barrowclough et al. 1999, Haig et al. 2004), morphological (Gutiérrez et al. 1995), and biogeographic information (Barrowclough and Gutiérrez 1990). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez et al. 1995). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, Chi et al. 2004, Barrowclough et al. 2005) and microsatellites (Henke et al., unpubl. data) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevadas, appears to be stable (Barrowclough et al. 2005).

Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. cited in USFWS 2007c). The northern spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be distinguished on the basis of plumage characteristics (Forsman 1981, Moen et al. 1991). The northern spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly and Forsman 2004). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994).

Current and Historical Range

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USFWS 1990a). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). These provinces are distributed across the species' range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands
- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath Mountains
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993).

Behavior

Spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990) suggesting that the area defended is smaller than the area used for foraging. Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

Spotted owls are monogamous and usually form long-term pair bonds. “Divorces” occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995).

Habitat Relationships

Home Range. Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USFWS 1990a). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas and Raphael 1993)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990) to 14,211 acres on the Olympic Peninsula (USFWS 1994b). Zabel et al. (1995) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (~20% of the home-range), often referred to as the core area (Bingham and Noon 1997). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, Sisco 1990).

Although differences exist in natural stand characteristics that influence home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, Bart 1995).

Habitat Use. Forsman et al. (1984) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Forsman 1975, Forsman et al. 1984).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, Forsman et al. 1984, Solis and Gutiérrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, Hershey et al. 1998). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, Buchanan et al. 1995, Hershey et al. 1998).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996).

Habitat Selection. Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al.

1990). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001) and protection from predators.

While spotted owls nest almost exclusively in trees, foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 1992b). Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 1992b). Although Forsman et al. (2002) found that spotted owls could disperse through highly fragmented forest landscapes, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Thomas et al. 1990, Diller and Thome 1999). In mixed conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan et al. 1995). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin et al. 2000).

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure) less often than expected based on this habitat's availability (Herter et al. 2002).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, Carey et al. 1990, Thomas et al. 1990). Glenn et al. (2004) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990) found that spotted owls foraged in areas with lower variance in prey densities (that is, where the occurrence of prey was more predictable) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995) showed that spotted owl home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and smaller where wood rats (*Neotoma* spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Zabel et al. 2003, Franklin et al. 2000, Meyer et al. 1998). In Oregon Klamath Mountains and Western Oregon Cascade provinces, Dugger et al. (2005) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger et al. 2005). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006). Olson et al. (2004) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson et al. (2004) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area.

Reproductive Biology

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984, Gutiérrez et al. 1995). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Miller et al. 1985, Franklin 1992, Forsman et al. 2002). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year (USFWS 1990b, Forsman et al. 1984, Anthony et al. 2006), and renesting after a failed nesting attempt is rare (Gutiérrez 1996). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (USFWS 1990a, Forsman et al. 1984). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman et al. 1984). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, Forsman et al. 2002).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Miller et al. 1997, Forsman et al. 2002). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002, Miller et al. 1997). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USFWS 1990a, Miller 1989). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, USFWS 1990a, Forsman et al. 2002). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, Gutiérrez 1989, Forsman et al. 2002). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear, although radio telemetry data indicate that spotted owls move around large water bodies rather than cross them (Forsman et al. 2002). Analysis of the genetic structure of spotted owl populations suggests that gene flow may have been adequate between the Olympic Mountains and the Washington Cascades, and between the Olympic Mountains and the Oregon Coast Range (Haig et al. 2001).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, Sovern et al. 1994). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath Mountains, California Klamath, and California Coastal provinces (Forsman et al. 1984, 2001, 2004, Ward et al. 1998, Hamer et al. 2001). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984, 2004, Ward et al. 1998, Hamer et al. 2001).

Other prey species such as the red tree vole (*Arborimus longicaudus),* red-backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects may be seasonally or locally important (reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r2 = 0.68), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003). Ward (1990) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 1984, 2001, 2004).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984, Gutiérrez et al. 1995). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000). In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996 and Zabel et al. 1996 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000).

Olson et al. (2005) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USFWS 1990a: 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USFWS 1992b). These threats were characterized for each province as severe, moderate, low or unknown (USFWS 1992b) (The range of the spotted owl is divided into 12 provinces from Canada to northern California and from the Pacific Coast to the eastern Cascades; see Figure 1). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl's range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

New Threats

The Service conducted a 5-year review of the spotted owl in 2004 (USFWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al. 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- "Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney and Gutiérrez 2004:11-7)
- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3% of the range-wide habitat base over a 10-year period)." (Courtney and Gutiérrez 2004:11-8)
- "Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations." (Courtney and Gutiérrez 2004:11-8)

Barred Owls. With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004), the barred owl's range now completely overlaps that of the northern spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001) or habitat (Hamer et al. 1989, Dunbar et al. 1991, Herter and Hicks 2000, Pearson and Livezey 2003). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily on retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003, Pearson and Livezey 2003, Olson et al. 2005). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to quantitatively evaluate the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer 1988, Iverson 1993). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, Gremel 2005, Schmidt 2006). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. The occupancy of historical territories by spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was “only marginally lower” ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003:51). Pearson and Livezey (2003) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area.

Olson et al. (2004) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004) was unfounded because of small sample sizes (Livezey 2005). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman, pers. comm., cited in USFWS 2007c). Anthony et al. (2006) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate.

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004). Consequently, hybridization with the barred owl is considered to be “an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space” (Kelly and Forsman 2004:808).

The preponderance of evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutiérrez et al. 2004, Olson et al. 2005). There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized" (Gutiérrez et al. 2004:7-38).

Wildfire. Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. Bond et al. (2002) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002). In a preliminary study conducted by Anthony and Andrews (2004) in the Oregon Klamath Mountains Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate.

In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997). Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire. In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1997). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. More research is needed to further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USFWS 1990a). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see "Habitat Trends" below). Moeur et al. (2005) suggested that 12 percent of late-successional forest rangewide would likely be negatively impacted by wildfire during the first 5 decades of the Northwest Forest Plan. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the spotted owl's range, in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004). The NWFP recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005).

West Nile Virus. West Nile virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001, Caffrey 2003, Marra et al. 2004). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, Komar et al. 2001). Recent tests of tree squirrels from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, pers. comm., cited in USFWS 2004). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding Eastern screech owls

(*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, pers. comm., cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, pers. comm., cited in Courtney et al. 2004). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Courtney et al. (2004) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One proposition is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative proposition is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's current range. Thus far, no mortality in wild, northern spotted owls has been recorded, however, WNV is a potential threat of uncertain magnitude and effect (Courtney et al. 2004).

Sudden Oak Death. Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading. At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 km of the central and northern California coast (Rizzo et al. 2002). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002). It has been found in several different forest types and at elevations from sea level to over 800 m. Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney et al. 2004).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity. Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, Haig et al. in press, Henke et al. unpublished). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad 2004). It is possible (but not necessarily the case) that the Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate Change. Climate change, a potential additional threat to northern spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related organismal diversity in the Matrix under the NWFP should contribute to the resiliency of the Federal forest landscape to the impacts of climate change (Courtney et al. 2004). There is no indication in the literature regarding the direction (positive or negative) of the threat.

Based upon a global meta-analysis, Parmesan and Yohe (2003) discussed several potential implications of global climate change to biological systems, including terrestrial flora and fauna. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001), subtle changes in climate have the potential to affect this. However, the specific impacts to the species are unknown.

Disturbance-Related Effects The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagan 1988). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Although information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout & Steidl 2001) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White & Thurow 1985, Andersen et al. 1989, McGarigal et al. 1991).

Northern spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia & Harvey 2000, Saplosky et al. 2000). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia & Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al.1997). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel & Gutiérrez 2003, Tempel & Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (see Wasser et al. 1997, Tempel & Gutiérrez 2004).

Post-harvest fuels treatments may also create above-ambient smoke or heat. Although it has not been conclusively demonstrated, it is anticipated that nesting northern spotted owls may be disturbed by heat and smoke intrusion into the nest grove.

Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs:

Habitat-specific Needs

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range distributed across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation;

2. Habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;

3. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

4. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to better understand the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USFWS 1992b), the Draft Recovery Plan (USFWS 1992b), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA and USDI 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows.

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.
- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.
- Blocks of habitat that are close together are better than blocks far apart.
- Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.
- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Federal Contribution to Recovery – NWFP (Conservation Strategy for the spotted owl)

Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (USDA and USDI 1994a, 1994b). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl, as well as to produce a predictable and sustainable level of timber sales. The NWFP was designed around reserve/connectivity functions that are expected to be achieved through a variety of LUAs. Each LUA has a distinct set of Standards and Guidelines that established goals and directs management actions that are consistent with NWFP expectations for ensuring appropriate management of reserves (large blocks) of late-successional and old-growth forest habitat to support multiple pairs of nesting owls and for connectivity between reserves in the intervening matrix. LUAs in the plan that are designed to support or contribute to supporting population clusters are: LSRs, Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas and Administratively Withdrawn areas can provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. Matrix areas may, in the short-term, contribute demographic support but is designed to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USDA and USDI 1994a, USFWS 1994a)) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USFWS 1992b) was based on the ISC report.

The Forest Ecosystem Management Assessment Team predicted, based on expert opinion, the spotted owl population would decline in the Matrix land use allocation over time, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, USDA and USDI 1994a, 1994b). Based on the results of the first decade of monitoring, Lint (2005) could not determine whether implementation of the NWFP would reverse the spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, Noon and Blakesley 2006). Bigley and Franklin (2004) suggested that more fuels treatments are needed in east-side forests to preclude large-scale losses of habitat to stand-replacing wildfires. Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection with WNV (which may or may not occur) may complicate the conservation of the spotted owl. Recent reports about the status of the spotted owl offer few management recommendations to deal with these emerging threats. The arrangement, distribution, and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Bigley and Franklin 2004).

Under the NWFP, the agencies anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Courtney et al. 2004, Anthony et al. 2006) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, Lint 2005). Even with the population decline, Courtney et al (2004) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing northern spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USFWS 2004). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered; even though, in the northern part of its range population trend estimates are showing a decline.

In April 2007, the Service published the 2007 Draft Recovery Plan for the spotted owl (USFWS 2007c). This draft plan outlines a three-part approach to recovering the spotted owl, including addressing the impacts of the barred owl on the spotted owl, establishing a network of habitat blocks to be managed for reproducing spotted owls, and monitoring the population trends and range of the spotted owl. The draft recovery plan recommends the experimental removal of barred owls to better understand the impact the species is having on spotted owls (USFWS 2007c). The plan also includes two separate options for establishing the habitat network; one which is a mapped option within the plan, and one which is a rule set that outlines how the BLM and Forest Service would establish a network on their lands (USFWS 2007c). The draft recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USFWS 2007c).

The effect of barred owls on NWFP Implementation

The Service believes that the NWFP still provides the backbone of the federal contribution to spotted owl recovery even with the uncertainty surrounding the effect of barred owls on spotted owls.

Reserve Network. The most important aspect of NWFP for spotted owls are the substantial forest reserves and related management standards. These reserves are separated by matrix habitat (suitable for dispersal and some breeding) and non-federal lands (which also have some roles as breeding and dispersal habitats). Invasion of protected reserves (such as the Olympic National Park area) by barred owls may lead to the loss of some conservation function of the reserve network. For example, Schmidt (2003) reported a decline of spotted owls in one such reserve in northern California. Pearson and Livezey (2003) established that the density of barred owls was highest in Gifford Pinchot National Forest LSRs and other reserve areas and lower in areas subject to harvest. Annual reports by Anthony et al. (2006) in both the central and southern Oregon Cascades show continued annual declines in spotted owl pair occupancy in the major land-use allocations of LSR, AMA and Matrix, while barred owl frequency is increasing, although the latter information is not given by land-use allocation. No information is provided in terms of spotted owl survival by land-use allocation.

If late-successional reserves fail to protect breeding populations of spotted owls, then the overall conservation strategy for the species is could be based on an untenable premise and may be questionable, unless the LSRs are not optimal habitat for spotted owls; see Franklin et al. (2000). The above data suggests that reserves are no protection against invasive owls, and other habitat management options, such as increased habitat protection (although see habitat discussion below) outside reserves may not have an additive affect helping spotted owl populations against barred owls.

One major limitation of the NWFP appears to be the inability of a reserve strategy, which comprises 80 percent of the NWFP federal land base (Thomas et al. 1994), to deal with invasive species, such as the barred owl. It is recognized that the NWFP has made important conservation contributions, and without the plan the situation of northern spotted owls would be far bleaker.

*Dispersal-Matrix Habitat***.** The NWFP provision of dispersal habitat in the matrix is an important component of long-term spotted owl conservation. Management of matrix habitat (15 percent of the NWFP federal land base) has been of lower impact on spotted owls than anticipated (Courtney et al. 2004, Lint 2005), yet decline in spotted owl populations are occurring in some areas. The NWFP provided for some protection of northern spotted owl nesting and foraging habitat within the matrix (e.g., reserves around nest sites) as well as maintenance of general conditions within the matrix that would facilitate dispersal of northern spotted owls and recovery of owl habitat following logging (e.g., variable retention harvesting). For these reasons, northern spotted owls are likely using matrix habitat more than anticipated as a consequence of lack of harvest activity in the matrix. However, the long-term suitability of matrix areas under a fully-implemented NWFP is impossible to assess at this point (Courtney et al 2004) and dispersal remains a difficult topic to study (Buchanan 2004).

Because dispersal habitat in the matrix is important for spotted owl conservation and if barred owls now occupy matrix habitat, one suggestion is that such areas may be less suitable for dispersal of young spotted owls, due to both direct antagonism (and possibly predation) and indirect inhibition (Courtney et al. 2004). An alternative view, and tenable under the current understanding of dispersal dynamics of northern spotted owls (Forsman et al. 2002), is that barred owl presence in matrix habitat may promote a faster progression of dispersing northern spotted owl juveniles through lower quality habitat. If barred owls exclude spotted owls, then spotted owls will likely spend less time in matrix habitat occupied by barred owls. If this were accomplished without reduced survivorship of spotted owls, there might be few or no negative consequences of barred owls occupying matrix habitat (Courtney et al. 2004).

Barred owls are known to use a wide variety of forest types, including early successional habitats, and some authors have suggested that timber harvest activities may favor the species. For instance, fragmentation of forest habitat may have created favorable conditions for survival and reproduction. By contrast, spotted owls appear to be more generally associated with old growth forest or forests that are structurally complex over a greater part of the species' range (Courtney et al. 2004). Under such conditions, timber harvest may have increased interpolation and contact of the two species' preferred and potential habitats, leading to increased competition between the species. Hicks et al. (2001) have attempted to examine this hypothesis in the northern part of the range by determining the amounts of different habitat types surrounding spotted owl territories that either have or have not been invaded by barred owls. They detected no effect of surrounding habitat on the probability of replacement. Also, under the Plum Creek HCP, harvest was deferred for areas of nesting, roosting and foraging habitat around 30 productive spotted owl sites. After six years, only 10 sites had any spotted owl presence – this rate of decline is very similar to that seen at other areas where timber harvest occurred. These results suggest something other than timber harvest is influencing occupancy in this location. However, overall, it is unclear if forest management affects the outcome of the interaction between the two species (Courtney et al. 2004, Chapter 8).

It is also clear that, in some portions of the northern spotted owl's range, barred owls are increasing and spotted owls are declining to some degree independently of forest management history in the area. For example, the population of spotted owls has decreased on both the Plum Creek Cascades HCP area (with extensive harvest) and nearby reserve areas without harvest (Courtney et al. 2004). Similarly, barred owls are increasing while spotted owls are declining throughout the Olympic peninsula in both industrial and national forest land, but also in the National Park (in areas never harvested) (Anthony et al. 2006 for trend information). On the Gifford Pinchot National Forest (Washington), the density and impact of barred owls appears higher in areas without timber harvest (Pearson and Livezey 2003). Although there is a strong overall correlation between barred owl increases and spotted owl declines, many historical spotted owl sites are not currently known to be occupied by either species (Wiedemeier and Horton 2000, Herter and Hicks 2000). Large numbers of truly vacant sites are not to be expected if the main cause of spotted owl decline is barred owl invasion and pre-emption of suitable sites (Courtney et al. 2004). Habitat loss to timber harvest is often postulated to be a major factor in spotted owl decline, but habitat is still present in the study areas (indeed some areas where spotted owls are in the worst decline, such as Olympic National Park, have never been harvested). Further, these results are not inconsistent with other factors that are known to negatively affect spotted owls. For example, Franklin et al. (2000) predicted, based on past weather data that there could be long periods of decline in a spotted owl population due solely to weather effects.

The Reserve and Matrix strategy of the NWFP has been successful in that northern spotted owl populations are persisting, and (largely) performing as predicted (Courtney et al. 2004). Continued cutting of northern spotted owl suitable habitat, in absence of a NWFP, might have accelerated the decline of the species and, possibly, facilitated more rapid displacement or occupation of vacated habitat by barred owls. However, the provision of suitable habitat for northern spotted owls was an essential contribution of the NWFP but has not protected it from competition from the invasive and highly competitive barred owl. At present, based on the habitat use patterns of both species and what little is known of interspecific competition, it is unclear whether additional habitat protection would improve conditions from the northern spotted owl.

Spotted Owl Population Declines and NWFP. Anthony et al. (2006) noted precipitous adult northern owl population declines on all four study areas in Washington. In northern Oregon, northern spotted owl population declines were noted in all three of the study areas, however, the declines were generally less than those in Washington (Anthony et al. 2006). The northern spotted owl has continued to decline in the northern portion of its range, despite the presence of a high proportion of protected habitat on Federal lands in that area. Although Courtney et al. (2004) indicate that the population decline of the northern spotted owl over the last 14 years was expected, they conclude that the greater than expected downward trends in certain study areas in Washington where little timber harvest was taking place suggest that something other than timber harvest is responsible for the recent decline. Anthony et al. (2006) stated that determining the cause of this decline was beyond the scope of their study, and that they could only speculate among the numerous possibilities including: competition from barred owls, loss of habitat from wildfire, timber harvest including lag effects from prior harvest, poor weather conditions, and defoliation from insect infestations. Not unexpectedly, considering the fact that the northern spotted owl is a predator species, Anthony et al. (2006) also noted the complexities of the relationships of prey abundance on predator populations, and identified declines in prey abundance as another possible reason for declines in apparent survival of northern spotted owls.

In southern Oregon and northern California, northern spotted owl populations are more stationary than in Washington (Anthony et al. 2006) despite the fact that more harvest is taking place in these areas than in areas experiencing greater than expected declines. The fact that northern spotted owl populations in some portions of the range were stationary was not expected within the first ten years, given the general prediction of continued declines in the population over the first several decades of NWFP implementation (Lint. 2005). The cause of the better demographic performance on the southern Oregon and northern California study areas, and the cause of declines in the Washington study areas are both unknown (Anthony et al. 2006). Although population declines in the Washington demographic areas exceeded anticipated levels, Courtney et al. (2004) noted that a range wide decline in the northern spotted owl population was not unexpected during the first decade, and that the observed range wide population change during this period was not a reason to doubt the effectiveness of the core NWFP conservation strategy. It is clear that there is no simple correlation with timber harvest patterns for instance (AFRC 2004), and barred owl invasion is certainly a viable hypothesis for this regional pattern (Courtney et al. 2004).

The synergistic effects of past threats and new threats are unknown. Although, the science behind the NWFP appears valid, new threats from barred owls, and potential threats from West Nile Virus and Sudden Oak Death may result in northern spotted owl populations in reserves falling to lower levels (and/or at a faster rate) than originally anticipated, which would further retard northern spotted owl recovery (Courtney et al. 2004). According to the Service (November 2004), the current scientific information, including that showing the declines in Washington and northern Oregon, and Canada, indicate that the northern spotted owl continues to meet the definition of a threatened species. Populations are still relatively numerous over most of the species' historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered even in the northern part of its range where greater than expected population declines were documented (USFWS 2004). The Service (November 2004) did not consider the increased risk to northern spotted owl populations due to the uncertainties surrounding barred owls and other factors sufficient to reclassify the species to endangered at this time. However, a problem in assessing this decline is that we lack a strong benchmark to know whether this decline is greater or less than that predicted under NWFP (Courtney et al. 2004).

A complication noted by some biologists in studying spotted owls is their belief that spotted owls are silent in the presence of barred owls (Olson et al. 2005, Crozier et al. 2006). Hence, an area may be recorded as vacated by spotted owls, when in fact the birds are merely unresponsive to surveyors' calls. Evidence contradictory to this hypothesis comes from the meta-analysis, where, if this scenario were true, we would expect to observe a decline in recapture rates for banded spotted owls in areas where barred owls are increasing, but this does not seem to be the case for any study area (Anthony et al. 2006).

Given the observed inverse correlations of some barred owl and spotted owl population trends, it is important to evaluate the relative effects of interspecific competition as a cause of spotted owl decline, as compared to other factors such as habitat loss. Historically, much of the observed loss of old-growth habitat occurred well before barred owls arrived in the region. Hence, there must have been substantial effects of habitat loss on spotted owl populations prior to the period 1965 to 1980 (when the barred owl arrived in western states). However, the arrival of the barred owl has introduced a new factor.

Previous estimates of spotted owl demographic parameters in 1994 (Burnham et al. 1994; Franklin et al. 1999) have produced substantial evidence that some populations at least are in decline. Of particular concern was the 1994 meta-analysis result that there was an accelerating rate of adult female mortality over the period study for the various demographic study areas. This trend was not apparent in the 1998 meta-analysis although some populations apparently were declining. Although habitat loss is one plausible explanation for such population trends, an alternative explanation is that barred owl invasion has been depressing spotted owl survival and reproduction. Recent studies have shown strong effects (Franklin et al. 2000) and relatively weak effects (Olsen et al. 2005) of some habitat conditions on spotted owl survival and reproduction. In demographic study areas where barred owls have been present the longest, and have been increasing through time, Anthony et al. (2006) noted strong evidence for negative effect of barred owl on survival on the Olympic and Wentachee, weak evidence for a barred owl effect on survival on the Cle Elum, but no effect of barred owls on fecundity on any demographic study population. Even a low level of competition may contribute to depressed demographic parameters.

Demographic data collected over 15 years document declining populations across the species range with the most pronounced declines in BC, WA, and northern Oregon. This area of pronounced decline constitutes approximately 50 percent of the geographic range of the northern spotted owl, but supports about 25 percent of all known northern spotted owl activity centers, and contains approximately 25 percent of all northern spotted owl habitat, greater than 90 percent of which is federally managed. These declines in Washington and northern Oregon demographic study areas, as well as Canada, indicate the northern spotted owl meets the definition of a threatened species. However, populations are still relatively numerous over most of the species historic range, suggesting the threat of extinction is not imminent, and the subspecies in not "endangered" even in the northern part of the range where the demographic results are least promising (USFWS 2004, p. 54)

In summary, a decline of northern spotted owl populations under the NWFP during the past decade was anticipated, however, Anthony et al. 2006 and Courtney et al. 2004 identified greater than expected northern spotted owl population declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. These reports did not find a direct correlation between habitat conditions and changes in northern spotted owl populations, and they were inconclusive as to the cause of the declines. Lag effects from prior harvest of suitable habitat, competition with barred owls, and habitat loss due to wildfire were identified as current threats. Complex interactions are likely among the various factors. The status of the northern spotted owl population, and increased risk to northern spotted owl populations due to uncertainties surrounding barred owls were reported as not sufficient to reclassify the species to endangered at this time. Similarly, the reports did not identify cause for changing the basic conservation strategy in the NWFP.

Conservation Efforts on Non-federal Lands

In the report from the Interagency Scientific Committee (Thomas et al. 1990), the draft recovery plan (USFWS 1992b), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993), it was noted that limited Federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-Federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The Service's primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to Federal lands, or their connectivity with Federal lands. In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are 17 current or completed Habitat Conservation Plans (HCPs) that have incidental take permits issued for spotted owls—eight in Washington, three in Oregon, and four in California. The HCPs range in size from 40 acres to more than 1.6 million acres, although not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million acres (9.1 percent) of the 32 million acres of non-Federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 5 to 100 years; however, most of the HCPs are of fairly long duration. While each HCP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent Federal reserves
- Forest harvest that maintains or develops suitable habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

Washington. In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Hanson et al. 1993, Buchanan et al. 1994). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USFWS 1992b).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (Oregon Department of Forestry 2007). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades.

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (California Department of Forestry and Fire Protection 2007). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the Service and that specify basic measures for spotted owl protection. Four HCPs authorizing take of spotted owls have been approved; these HCPs cover more than 669,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands.

Current Condition of the Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USFWS and USDC NMFS 1998).

Range-wide Habitat and Population Trends

Habitat Baseline. The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USDI 1992b). However, reliable habitat baseline information for non-Federal lands is not available (Courtney et al. 2004). The Service has used information provided by the Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994a) was believed to be representative of the general amount of spotted owl habitat on these lands. This baseline has been used to track relative changes over time in subsequent analyses, including those presented here.

In 2005 a new map depicting suitable spotted owl habitat throughout the range of the spotted owl was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it non-habitat for tracking habitat effects at the scale of individual projects. The Service is evaluating the map for future use in tracking habitat trends. Additionally, there continues to be no reliable estimates of spotted owl habitat on non-Federal lands; consequently, consulted-on acres can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat.

NWFP Lands Analysis 1994 – 2001. In 2001, the Service conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USFWS 2001). This range-wide evaluation of habitat, compared to the FSEIS, was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the Service considered habitat effects that were documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the NWFP land-use allocations (USDA and USDI 1994a), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USFWS 2001).

Range-wide Analysis from 1994 to August 2, 2007. This section updates the information considered in USFWS (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease). To track impacts to spotted owl habitat, the Service designed the Consultation Effects Tracking System database which records impacts to spotted owls and their habitat at a variety of spatial and temporal scales. Data are entered into the database under various categories including, land management agency, land-use allocation, physiographic province, and type of habitat affected.

In 1994, about 7.4 million acres of suitable northern spotted owl habitat were estimated to exist on Federal lands managed under the NWFP. As of August 2, 2007, the Service had consulted on the proposed removal of approximately 202,368 acres[3] (Table) or 2.73 percent of 7.4 million acres (Table) of northern spotted owl suitable habitat on Federal lands. Of the total Federal acres consulted on for removal, approximately 179,633 acres or 2.42 percent of 7.4 million acres of northern spotted owl habitat were removed as a result of timber harvest. These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP (USDA and USDI 1994a).

[3] Due to the query type and combination of data categories in the NWFP and Section 7 Consultation Effects Tracker system, the NWFP subtotal for removed/downgraded in Table is 11,497 acres greater than the NWFP land use allocation removed/downgraded totals (Reserves and Non-reserves) in

April 13, 2004 marked the start of the second decade of the NWFP. Decade specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but can be calculated using the Service's Consultation Effects Tracking system.

Habitat loss from Federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (Table). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (83.24%), especially within its Klamath (48.81%) and Western Cascades (24.35%) Provinces (Table), followed by much smaller habitat losses in Washington (7.87%) and California (8.89%) (Table). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (22.27%), Oregon Eastern Cascades (7.20%), and the California Cascades (5.45%) all have proportional losses greater than the range-wide mean (4.85%)(Table).

From 1994 through August 2, 2007, habitat lost due to natural events was estimated at approximately 167,894 acres (range-wide)(Table). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of spotted owl habitat, including habitat within five LSRs (Table). Approximately 18,630 acres of spotted owl habitat were lost due to the B&B Complex and Davis Fires in the Oregon Eastern Cascades Province (Table).

Because there is no comprehensive spotted owl habitat baseline for non-Federal lands, there is little available information regarding spotted owl habitat trends on non-Federal lands. Yet, we do know that internal Service consultations conducted since 1992, have documented the eventual loss of 419,412 acres (Table) of habitat on non-Federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on Federal and non-Federal lands, the Service had consulted on the proposed removal of approximately 622,021 acres of spotted owl habitat range-wide, resulting from all management activities, from 1994 to August 2, 2007 (Table).

Other Habitat Trend Assessments. In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005) estimated there was 816,000 acres of suitable spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce et al. (2005) estimated there were less than 2.8 million acres of spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56%) occurred on Federal lands, and lesser amounts were present on state-local lands (21%), private lands (22%) and tribal lands (1%). Most of the harvested spotted owl habitat was on private (77%) and state-local (15%) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce et al. (2005) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005).

Moeur et al. (2005) estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres. The estimates were based on change-detection layers for losses due to harvest and fire and remeasured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of Forest Service land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with northern spotted owl habitat, the significance of these acres to northern spotted owl conservation remains unknown.

Spotted Owl Numbers, Distribution, and Reproduction Trends. There are no estimates of the size of the spotted owl population prior to settlement by Europeans. Spotted owls are believed to have inhabited most old-growth forests or stands throughout the Pacific Northwest, including northwestern California, prior to beginning of modern settlement in the mid-1800s (USFWS 1989). According to the final rule listing the spotted owl as threatened (USFWS 1990a), approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on Federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of spotted owls on private lands in northern California was slightly higher (Forsman et al. 1984, USFWS 1989, Thomas et al. 1990).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USFWS 1990a). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993).

The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

As of July 1, 1994, there were 5,431 known site-centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites (31 percent) in California (USFWS 1995). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USFWS 1992b, Thomas et al. 1993). In addition, historical sites may no longer be occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The totals in USFWS (1995) represent the cumulative number of locations recorded in the three states, not population estimates.

Because the existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, demographic data are used to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the finite rate of population change (λ), which provides information on the direction and magnitude of population change. A λ of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A λ of less than 1.0 indicates a decreasing population, and a λ of greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992, Burnham et al. 1994: Forsman et al. 1996, Anthony et al. 2006) to estimate trends in the populations of the spotted owl.

In January 2004, two meta-analyses modeled rates of population change for up to 18 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled all 13 long-term study areas excluding the Marin study area, while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Anthony et al. 2006). Data were analyzed separately for individual study areas, as well as across all study areas in a meta-analysis.

Point estimates of λ_{RJS} ranged from 0.896 to 1.005 for the 13 long-term study areas, and in all study areas but one—the Tyee study area—these estimates were less than 1.0 (Anthony et al. 2006). There was strong evidence that populations in the Wenatchee, Cle Elum, Warm Springs, and Simpson study areas decreased during the period of study. There also was evidence that populations in the Rainier, Olympic, Oregon Coast Range, and HJ Andrews study areas were decreasing. The precision of the λ_{RJS} estimates for Rainier and Olympic study areas was poor and not sufficient to detect a statistically significant difference from 1.00; however, the estimate of λ_{RJS} for the Rainier study area (0.896) was the lowest of all of the areas. Populations in the Tyee, Klamath, South Oregon Cascades, Northwest California, and Hoopa study areas appeared to be stationary during the study, but there was some evidence that the spotted owl population in the Northwest California study area was decreasing (λ_{RJS} = 0.959 to 1.011).

The weighted mean λ_{RJS} for all of the study areas was 0.963 (standard error [SE] = 0.009, 95 percent confidence interval [CI] = 0.945 to 0.981), suggesting that populations over all of the study areas decreased by about 3.7 percent per year from 1985 to 2003. The mean λ_{RJS} for the eight demographic monitoring areas that are part of the effectiveness monitoring program of the NWFP was 0.976 (SE = 0.007, 95 percent CI = 0.962 to 0.990), and the mean λ_{RJS} for the other five study areas was 0.942 (SE = 0.016, 95 percent CI = 0.910 to 0.974), yielding average declines of 2.4 and 5.8 percent per year, respectively. These data suggest that demographic rates for spotted owl populations on Federal lands were better than elsewhere; however, both the interspersion of non-Federal land in study areas, and the likelihood that spotted owls use habitat on multiple ownerships in some demography study landscapes, confound this comparison.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Wenatchee, Cle Elum, and Rainier study areas in Washington and the Warm Springs study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period of 1990 to 2003 (Anthony et al. 2006). Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends. Survival rates decreased over time in five of the 14 study areas: four study areas in Washington, which showed the sharpest declines, and one study area in the California Klamath Province of northwest California (Anthony et al. 2006). In Oregon, there were no time trends in apparent survival for four of six study areas, and remaining areas had weak, non-linear trends. In California, three study areas showed no trend and one showed a significant linear decrease (Anthony et al. 2006). Like the trends in annual rate of population change, trends in the rate of adult survival showed clear decreases in some areas but not in others.

Loehle et al. (2005a) sampled a small portion of the range of the species and questioned the accuracy of lambda estimates computed in Anthony et al. (2005, subsequently published as Anthony et al. 2006), suggesting that the estimates were biased low by 3 to 4 percentage points. Loehle et al. (2005a) contended the lambda estimates in Anthony et al. (2006) did not accurately account for spotted owl emigration. Therefore, more of the spotted owl demography study areas would have a lambda closer to 1.0, a stationary population. Loehle et al. (2005b) then published an erratum acknowledging that the more recent analysis methods used in Anthony et al. (2006) did not cause them concern regarding potentially miscalculated permanent emigration rates. Subsequently, Franklin et al. (2006) published a comment indicating the Loehle et al. (2005a) survival estimates were inappropriate for comparison because they introduced a positive bias to the measure of population change, were not valid for evaluating bias, and their study areas were too different from the demography study areas to allow for comparison.

British Columbia has a small population of spotted owls. This population is relatively isolated from populations in Washington and appears to be declining sharply; spotted owls are absent from large areas of apparently suitable habitat (Chutter et al. 2004). Breeding populations have been estimated at fewer than 33 pairs and may be declining by as much as 35 percent per year (Chutter et al. 2004). The amount of interaction between spotted owls in Canada and the United States is unknown (Chutter et al. 2004). The Canadian population has now reached the point at which it is vulnerable to random, naturally occurring demographic events that could cause further declines and perhaps extirpation. Chutter et al. (2004) suggest that immediate action is required to improve the likelihood of recovering that population in British Columbia.

Table 5. Changes to northern spotted owl suitable[1] habitat acres from activities addressed in section 7 consultations (both formal and informal) and other causes, range-wide from 1994 to August 2, 2007.

Northwest Forest Plan (NWFP) Group /Ownership		Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Maintained	Removed/ Downgraded	Maintained
Federal - Northwest Forest Plan	Bureau of Land Management	85452	29113	760	0
	Forest Service	97875	452977	29832	5481
	National Park Service	3866	3316	3	0
	Multi-agency[4]	15175	23314	0	0
	NWFP Subtotal	202368	508720	30595	5481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	109370	28349	2398	0
	Habitat Conservation Plans	295889	14430	0	0
	OMCP Subtotal	405259	42779	2398	0
Other Federal Agencies & Lands[5]		241	466	28	70
Other Public & Private Lands[6]		14153	880	30240	20949
TOTAL Changes		622021	552845	63261	26500

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] Includes both effects reported by USFWS (2001) and subsequent effects compiled in the Spotted Owl Consultation Effects Tracker (web application and database).

[3] Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to 6/26/2001, and cannot be split out.

[5] Includes lands that are owned or managed by other federal agencies not included in the NWFP.

[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across Forest Service and BLM lands are included here.

Table 6. Acres of northern spotted owl suitable (NRF[1]) habitat loss on Federal lands from 1994 to August 2, 2007, from proposed management activities and natural events: baseline and summary of effects by State, physiographic province and land use function.

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]				% Provincial Baseline Affected	% of Range-wide Effects
		Reserves[5]	Non-reserves[6]	Total	Reserves[5]	Non-reserves[6]	Habitat loss to natural events[7]	Total		
WA	Olympic Peninsula	548483	11734	560217	867	24	299	1190	0.21	0.33
	Eastern Cascades	506340	200509	706849	3783	5014	5754	14551	2.06	4.06
	Western Cascades	864683	247797	1112480	1681	10804	0	12485	1.12	3.48
	Western Lowlands	0	0	0	0	0	0	0	0.00	0.00
OR	Coast Range	422387	94190	516577	479	3684	66	4229	0.82	1.18
	Klamath Mountians	448509	337789	786298	1998	71442	101676[8]	175116	22.27	48.81
	Eastern Cascades	247624	196035	443659	1243	11152	19547[9]	31942	7.20	8.90
	Western Cascades	1012426	1033337	2015763	3581	59208	24583	87372	4.33	24.35
	Willamette Valley	593	5065	5658	0	0	0	0	0.00	0.00

CA	Coast Range	47566	3928	51494	405	69	100	574	1.11	0.16
	Cascades	61852	26385	88237	0	4808	0	4808	5.45	1.34
	Klamath	734103	345763	1079866	1470	9159	15869	26498	2.45	7.39
Total		4894566	2502532	7397098	15507	175364	167894	358765	4.85	100.00

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] 1994 FSEIS baseline (USDA and USDI 1994b).

[3] Includes consulted-on effects reported by USFWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System database.

[4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

[5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs

[6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

[7] Acres for all physiographic provinces, except the Oregon Klamath Mountains and Oregon Eastern Cascades, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

[8] Acres are from the biological assessment entitled: Fiscal year 2006-2008 programmatic consultation: re-initiation on activities that may affect listed species in the Rogue-River/South Coast Basin, Medford BLM, and Rogue-Siskiyou National Forest.

[9] Acres are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004) and data in the Northern Spotted Owl Consultation Effects Tracking Database.

	Demographic Study Area	*Land Ownership*	*# Owls Banded*	*Fecundity*	*Apparent Survival*	λ_{RJS}	*Population Trend Based on* $\Delta\lambda$
	Washington						
■	Wenatchee (WEN)	Private	1,200	Stable	Declining	0.917	Declining
■	Rainer (RAI)	USFS	217	Stable	Declining	0.896	Declining
■	Olympic (OLY)	NPS & USFS	985	Stable	Declining	0.956	Declining
▨	Cle Elum (CLE)	USFS	724	Declining[1]	Declining?[2]	0.938	Declining
	Oregon						
■	Oregon Coast Range (COA)	USFS & BLM	1,025	Declining?[1]	Stable	0.968	Declining
■	Tyee (TYE)	BLM & Private	1,032	Increasing	Stable	1.005	Stationary
■	South Oregon Cascades (CAS)	USFS & BLM	881	Declining	Stable	0.974	Stationary
▨	H.J. Andrews (HJA)	USFS	1,095	Stable?[3]	Stable	0.978	Declining
⊠	Klamath (KLA)	BLM & Private	1,147	Stable	Stable	0.997	Stationary
▩	Warm Springs (WSR)	Tribal	381	Stable	Stable	0.908	Declining
	California						
■	Marin (MAR)	NPS	96	Stable	Stable	NA	NA
■	Simpson (SIM)	Private	1,344	Declining[1]	Stable	0.970	Declining
■	Hoopa (HUP)	Tribal	279	Increasing	Stable	0.980	Stationary
▨	NW California (NWC)	USFS	1,026	Declining	Declining	0.985	Declining?[4]

[1] Best model included age and even-odd year effects, but a competing model had a negative time effect on productivity.
[2] Variable among years, but with a declining trend.
[3] Decreasing in early years, increase in last 5 years, stable overall.
[4] Gradual declines in fecundity and apparent survival, plus estimates of realized population change suggest a decline in last 8 years.

Figure 1. Physiographic provinces, northern spotted owl demographic study areas, and demographic trends (Anthony et al. 2004).

Status of Northern Spotted Owl Critical Habitat

Legal Status

On January 15, 1992, the Service designated critical habitat for the spotted owl within 190 critical habitat units (CHUs) which encompass nearly 6.9 million acres across Washington (2.2 million acres), Oregon (3.3 million acres), and California (1.4 million acres) (USFWS 1992b). Only Federal lands were designated as critical habitat in the final rule (USFWS 1992b). The spotted owl critical habitat final rule states: "Section 7 analysis of activities affecting owl critical habitat should consider provinces, subprovinces, and individual CHUs, as well as the entire range of the subspecies (page 1823)." The rule goes on to assert the basis for an adverse modification opinion should be evaluated at the provincial scale (page 1823). On June 12, 2007, the Service issued a proposal to revise the existing designation of critical habitat for the spotted owl (USFWS 2007d).

We have estimated the minimum number of spotted owl sites each CHU should be able to support, based on the provincial home range size of approximately 3,000 acres and the amount of capable lands within the CHU. Capable lands are currently suitable spotted owl habitat or are capable of becoming suitable habitat in the future. Non-capable lands are areas such as open water, rock talus slopes, or soils that are not capable of producing large trees. Since there is some overlap of spotted owl home ranges, some home ranges straddle CHU boundaries, and suitable habitat is not homogenous across the landscape, more than the minimum number of owl sites may occur within a CHU.

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the spotted owl critical habitat final rule include those physical and biological features that support nesting, roosting, foraging, and dispersal (USFWS 1992b). Features that support nesting and roosting habitat typically include a moderate to high canopy (60 to 90 percent); a multi-layered, multi-species canopy with large [> 30 inches diameter at breast height] overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas et al. 1990). Foraging habitat generally consists of attributes similar to those in nesting and roosting habitat, but may not always support successfully nesting pairs (USFWS 1992b). Dispersal habitat, at minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities: there may be variations over the owl's range (e.g., drier sites in the east Cascades or northern California) (USFWS 1992b).

Conservation Role of Critical Habitat

Spotted owl critical habitat was designated based on the identification of large blocks of suitable habitat that are well distributed across the range of the spotted owl. Critical habitat units were intended to identify a network of habitats that provided the functions considered important to maintaining stable, self-sustaining, and interconnected populations over the range of the spotted owl, with each CHU having a local, provincial, and a range-wide role in spotted owl conservation. Most CHUs were expected to provide suitable habitat for population support, some were designated primarily for connectivity, and others were designated to provide for both population support and connectivity. Approximately 70 percent of extant suitable habitat in CHUs overlaps with Northwest Forest Plan (NWFP) Late-Successional Reserves on a range-wide basis and will therefore be managed to protect and enhance habitat characteristics.

Current Condition of Critical Habitat

Range-wide

In 1994, the FSEIS for the NWFP established that 3,141,987 acres of NRF habitat existed within spotted owl CHUs on federally administered public lands. To assess changes to the baseline condition since implementation of the NWFP, the Service relies on information in section 7 consultations and available information on natural events. Hereafter, effects to critical habitat refer to NRF habitat within spotted owl critical habitat.

Across the range of the spotted owl between 1994 and August 2, 2007, the Service has consulted on the removal and/or downgrading of 51,784 acres (1.65 %) of critical habitat due to management-related activities. The majority of these effects, 33,196 acres (64.10%), have been concentrated in the Oregon Western Cascades and Oregon Klamath Mountains Provinces. In addition, natural events (including fire and insect outbreaks) have resulted in the removal or downgrading of approximately 39,078 acres (1.24 %) of critical habitat extant in 1994. In general, fires have had more of an impact to spotted owl critical habitat in the interior provinces of Washington and California and the southern and interior provinces of Oregon than the coastal provinces.

Data indicate that affected suitable critical habitat acres have not been evenly distributed among the physiographic province (% of Total Effects. The majority of the effects (approximately 57.08 % totaling 51,865 acres) to suitable spotted owl critical habitat have occurred in the Oregon Klamath Mountains and Oregon Western Cascades physiographic provinces. Besides providing large blocks of suitable habitat to support population clusters and intra-provincial connectivity, these provinces also provide important inter-provincial links. The Oregon Klamath Mountains province provides a link between the Oregon Coast Range and Oregon Western Cascades provinces and south into the northern California provinces. The northern portion of the Western Oregon Cascades province provides the link to the Washington Cascades across the Columbia Gorge area of concern while the southern portion of this province shares the three linkage areas within the I-5 area of concern which connect this province with the Oregon Coast Range and Oregon Klamath Mountains provinces (USFWS 2001).

Consultation data also indicates that the percent reduction of suitable critical habitat within each physiographic province has not been evenly distributed (% Provincial Baseline Affected. Although there is not as much of a spread as the total effects, two physiographic provinces have greater than 4 percent of critical habitat removed or downgraded since 1994. Oregon Klamath Mountains has had 9.51 percent of the provincial base line affected, and Oregon Eastern Cascade has had 7.81 percent of the provincial base line affected. Of the remaining ten provinces, one (Oregon Willamette Valley) had no designated critical habitat, one (Washington Western Lowlands) had no suitable habitat within critical habitat, two had no effects to critical habitat (Washington Western Cascades and California Coast), and six provinces (Washington Olympic Peninsula, Washington Eastern Cascades, Oregon Coast Range, Oregon Western Cascades, California Cascades, and California Klamath) had less than 4 percent of the critical habitat removed or downgraded since 1994.

Provinces with the Majority of Impacts Range-wide or to Their Baseline

Oregon Klamath Mountains. The Oregon Klamath Mountains Province contains 16 CHUs and provides the link between the Oregon Western Cascades and Oregon Coast Ranges Province south into California (Tweten 1992).

Between 1994 and August 2, 2007, this province has had more critical habitat removed and/or downgraded than any other province: 28,677 acres or approximately 9 percent of its provincial baseline. Of these acres, 17,453 can be attributed to fire while the remaining 11,224 acres are associated with consulted-on activities. Consulted-on effects have been distributed across 12 CHUs. The majority of fire effects in this province can be attributed to the Biscuit Fire. This fire removed and/or downgraded approximately 23, 46, and 37 percent of the suitable habitat within OR-68, OR-69, and OR-70, respectively. These units were identified for their important contributions to inter- and intra-provincial connectivity and to provide essential NRF and dispersal habitat in areas where habitat is lacking (Tweten 1992).

Oregon Cascades West. This province is located in the geographic center of the spotted owl's range and contains more critical habitat (over 894,000 acres) than any other province. It provides links with the Washington Cascades, Oregon Coast Range, Oregon Klamath Mountains, Oregon Eastern Cascades Provinces, and connectivity with the California physiographic provinces (Tweten 1992).

Between 1994 and August 2, 2007, approximately 23,188 acres (2.59 percent of this province's baseline) have been removed and/or downgraded. Consulted-on effects have been widely dispersed within 27 of the 29 CHUs in this province. In general, this has resulted in relatively small impacts to individual units. Fire has had limited effects to spotted owl critical habitat in this province: 1,216 acres or less than 0.5 percent of the provincial baseline have been removed and/or downgraded by fire.

Oregon Eastern Cascades. The Oregon Eastern Cascades Province provides the easterly extension of the spotted owl's range in Oregon and contains all or portions of 10 CHUs.

Between 1994 and August 2, 2007, 10,833 acres or 7.81 percent of its provincial baseline have been removed and/or downgraded . The majority of these acres, approximately 6,878, are a result of several fires during 2002 and 2003. The impacts of these fires were concentrated in the central portion of this province where approximately 20 percent of the extant suitable habitat in OR-3 and OR-4 and over 36 percent of the suitable habitat in OR-7 were removed and/or downgraded. OR-3 and OR-4 were designated to maintain suitable habitat and support dispersal along the eastern slope of the Oregon Cascades (Tweten 1992). OR-7 provides a north-south link within the province and an inter-provincial link with the Oregon Cascades West Province. Consulted-on effects have occurred in 7 of the 10 CHUs in this province.

Summary

This evaluation of critical habitat indicates that there have been effects to individual CHU since 1994. However, these effects have not prevented the CHU network from providing for spotted owl recovery across the species' range. The Service reached this conclusion based on the following reasons: (1) in 2001 the Service evaluated critical habitat and concluded that "effects to critical habitat do not impair its ability to provide for conservation across the range of the (spotted) owl" (USFWS 2001), and (2) only an additional 1.69 percent of designated critical habitat has been affected range-wide since the 2001 range wide update, including consulted on management activities, fire and insect/disease.

The NWFP's network of LSRs overlap designated critical habitat by about 70 percent along with owl habitat in other LUAs and in the Matrix contributing to connectivity (and some population support). Although the NWFP was designed using the ISC principles and incorporated recommendations from the owl recovery team (USFWS 1992b), it did not substitute for the network of designated critical habitat. The assessment of critical habitat condition and function for this BO was analyzed independent of the contribution that the LSR network provides to spotted owl conservation.

Baseline

Table 7 shows the status of northern spotted owl habitat and the estimated number of nest sites within the Willamette National Forest. Nest sites are based on either survey data or predicted sites from a USFWS occupancy template (USFWS, 2007e). Known sites are pairs or resident singles from historic surveys with some updates from recent surveys. According to the protocol for surveying (March 17, 1992), a historical site is only considered unoccupied if three years of surveys show no response from spotted owls. There is also an assumption that historic sites have a high likelihood of continued occupancy (Lint pers. comm. 2006).

The USFWS occupancy template methodology (USFWS, 2007e) is intended to facilitate a reasonable basis for estimating potentially occupied spotted owl habitat on a given landscape along with estimating the number of northern spotted owls that are likely to occur within the area affected by a proposed Federal action. The template relies on known spotted owl locations derived from spotted owl surveys as the foundation for the template. To estimate likely occupied habitat, outside of known home ranges, spotted owl density estimates and spotted owl habitat usage from the demography studies on the HJ Andrews study area were utilized to identify areas that could support a nesting pair. The known sites and the template sites then become the foundation upon which to conduct an effects analysis (see the Effects Analysis section).

For this consultation, the Analysis Area is a 2.4 mile buffer around all project units that may change habitat conditions for the spotted owl. The analysis area is within the H.J. Andrews northern spotted owl demographic study area and monitoring of owl populations have occurred since 1987 (Anthony et al. 2006). There are nineteen known activity centers within the Analysis Area. Occupancy modeling by USFWS predicted no new home ranges undetected by surveys so all the effects analysis are based on survey data. Steve Ackers (H.J. Andrews NSO monitoring project leader) was consulted about the activity center location for MSNO 2836 due to recent changes in the nest site for the pair. Seven spotted owl home ranges overlap project units. Table 8 shows these home ranges and the current pre-treatment habitat status for these owls within the action area.

The action area is defined in the implementing regulations for section 7 at 50 CFR 402 as, "all areas to be affected directly or indirectly by Federal action and not merely the immediate area involved in the action." For this consultation, the action area is the footprint of the proposed timber sale, road construction, and rock quarry development plus all federal and non-federal lands within one mile. A one mile radius of the project footprint is being used since blasting can create noise above ambient levels out to about one mile.

The action area consists of the following land use allocations on Forest Service land: Adaptive Management Area and eight 100-acre LSRs. A portion of the action area is found within Critical Habitat Units OR-16. Other land ownerships in this area include private, COE and state.

The habitat condition of private ground within the affected home ranges as shown in Table 8 is almost entirely non habitat for owl sites 0104, 2034, and 2836. For owl sites 0856 and 2443 the habitat condition is approximately 70% and 80% non habitat respectively with the remaining acres likely to be harvested into non habitat in the foreseeable future, given current private timber ground harvest practices. The project analysis assumes that private lands are all non habitat for spotted owls. Owl sites 0029 and 2422 have no private ground within their designated home ranges.

No activity that would remove or downgrade northern spotted owl habitat in an Area of Concern (AOC) is proposed in this project or addressed by this assessment.

Table 7. Status of the current northern spotted owl and its habitat on the Willamette NF.

		Total Acres	Protected[1]		Unprotected[2]	
			Total Acres	% of Total[1]	Total Acres	% of Total[2]
Acres within Boundary[3]		1,799,323	854,411	47%	835,963	46%
Acres of Ownership[4]		1,685,602	852,518	51%	832,515	49%
Suitable Habitat - Capable Acres[5]		1,418,739	684,237	48%	734,158	52%
Suitable Habitat - Current Acres		817,158	443,274	54%	373,683	46%
Northern Spotted Owl Suitable Habitat within 1.2 mile of Known or Predicted Spotted Owl Sites		**Number of Sites**	**Protected**	**% of Total**	**Unprotected**	**% of Total**
Northern spotted owl Sites	Known sites	524	387	74%	137	26%
	Predicted sites	189	136	72%	53	28%
	Total	**713**	**523**	**73%**	**190**	**27%**
Spotted owl sites > 40% suitable	Known sites	424	315	74%	109	26%
	Predicted sites	111	86	77%	25	23%
	Total	**535**	**401**	**75%**	**134**	**25%**
Spotted owl sites 30-40% suitable	Known sites	60	40	67%	20	33%
	Predicted sites	19	9	47%	10	53%
	Total	**79**	**49**	**62%**	**30**	**38%**
Spotted owl sites < 30% suitable	Known sites	40	32	80%	8	20%
	Predicted sites	59	41	69%	18	31%
	Total	**99**	**73**	**74%**	**26**	**26%**

[1] Acres in this column are comprised of: Late Successional Reserves (LSR) and associated Riparian Reserves, 100-acre LSRs, Congressionally Withdrawn Areas.

[2] Acres in this column are comprised of: Matrix, Adaptive Management Areas, and Administratively Withdrawn Areas including associated Riparian Reserves. Administratively Withdrawn Areas are included in the unprotected column because technically these areas are not designed to provide spotted owl habitat but rather to serve some other function such as "recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest" (USDA, and USDI 1994a, p. A-4). The administrative land and resource management plan may protect and/or reduce the likelihood that spotted owl habitat located within Administratively Withdrawn Areas would be modified.

[3] Acres include both private and federal lands. Acres are derived from corporate GIS data.

[4] Federal land only.

[5] Acres that are either currently suitable spotted owl habitat or have the potential to become suitable in the future. Suitable habitat is defined as nesting, roosting, and foraging habitat.

[6] Known sites represent pairs or resident singles 1990-2006. Predicted sites are those which represent occupancy based on habitat utilization using demographic study data – provided by the FWS.

[7] Known or predicted sites with greater than or equal to 1182 acres of suitable habitat within a 1.2 mile radius.

[8] Known or predicted sites that have between 886 and 1182 acres of suitable habitat within a 1.2 mile radius.

[9] Known or predicted sites with less than 886 acres of suitable habitat within a 1.2 mile radius.

Table 8. Current condition of Northern Spotted Owl Known Sites within the Action Area (in acres).

MSNO	NSO Habitat	Matrix	Adaptive Management Area	Late Successional Reserve	NonFS land*	Off Forest*	Grand Total Acres	Suitable Habitat % of Total
Current NSO Habitat within 200 meter Nest Patch								
0029	suitable		7	24			31	100%
0029 Total Acres		7		24			31	
0104	suitable			31			31	100%
0104 Total Acres				31			31	
0856	suitable			12			12	39%
	non-habitat		4	3			7	
	private				8		8	
	off forest					4	4	
0856 Total Acres		4		15	8	4	31	
2034	suitable		1	24			25	82%
	dispersal						0	
	non-habitat		5	1			6	
2034 Total Acres		5		26			31	
2422	suitable		8	19			27	85%
	dispersal		3				3	
	non-habitat		1				1	
2422 Total Acres		12		19			31	
2443	suitable		27	1			28	92%
	non-habitat		3				3	
2443 Total Acres		29		2			31	
2836	suitable			25			25	80%
	dispersal		2				2	
	non-habitat		4				4	
2836 Total Acres		6		25			31	
Grand Total Acres		63		142	8	4	217	
Current NSO Habitat within 0.5 mile Core Area								
0029	suitable		308	102			411	82%
	dispersal		52	0			52	
	non-habitat		41				40	
0029 Total Acres			401	102			503	
0104	suitable		92	112			203	40%
	dispersal		77				77	
	non-habitat		222	0			223	
0104 Total Acres			391	112			503	

MSNO	NSO Habitat	Matrix	Adaptive Management Area	Late Successional Reserve	NonFS land*	Off Forest*	Grand Total Acres	Suitable Habitat % of Total
0856	suitable		44	68	1		113	22%
	non-habitat		79	3	10		93	
	private		2		218		220	
	(blank)		0		0	77	77	
0856 Total Acres			125	71	229	77	503	
2034	suitable		145	99			244	49%
	dispersal		155	0			155	
	non-habitat		101	3			104	
2034 Total Acres			401	102			503	
2422	suitable		217	96			313	62%
	dispersal		160	1			161	
	non-habitat		27	2			28	
2422 Total Acres			404	99			503	
2443	suitable		108	71	0		179	36%
	dispersal		28	26			54	
	non-habitat		53	2	0		55	
	private		0	1	214		215	
2443 Total Acres			189	100	214		503	
2836	suitable		157	99			256	51%
	dispersal		166	1			167	
	non-habitat		79	1			80	
2836 Total Acres			402	101			503	
Grand Total Acres			2,313	687	443	77	3,520	
Current NSO Habitat within 1.2 mile Home Range								
0029	suitable		1,211	288			1,498	52%
	dispersal		664	74			738	
	nonhabitat		652	6			659	
0029 Total Acres			2,527	369			2,895	
0104	suitable		634	141	1		776	27%
	dispersal		747	91			839	
	nonhabitat		1,010	1			1,011	
	other agency				223		223	
	private				46		46	
0104 Total Acres			2,391	233	271		2,895	
0856	suitable		506	95	5		606	21%
	dispersal	2	438		9		449	
	nonhabitat	2	553	4	26		585	
	private		8		672		680	
	off-forest					575	575	
0856 Total Acres		3	1,505	99	713	575	2,895	

MSNO	NSO Habitat	Matrix	Adaptive Management Area	Late Successional Reserve	NonFS land*	Off Forest*	Grand Total Acres	Suitable Habitat % of Total
2034	suitable		928	99			1,028	35%
	dispersal		1,089				1,090	
	nonhabitat		732	3			735	
	private		2		41		43	
2034 Total Acres			2,752	102	41		2,895	
2422	suitable		1,388	388			1,775	61%
	dispersal		711	30			741	
	nonhabitat		371	8			378	
2422 Total Acres			2,469	426			2,895	
2443	suitable		384	75			458	16%
	dispersal		743	31			773	
	nonhabitat		322	2	3		327	
	private		1	1	1,335		1,336	
2443 Total Acres			1,449	108	1,338		2,895	
2836	suitable		1,002	157			1,160	40%
	dispersal		1,100	84			1,184	
	nonhabitat		547	3			549	
	private				2		2	
2836 Total Acres			2,649	244	2		2,895	
Grand Total Acres		3	15,743	1,581	2,365	575	20,267	

* Note that Non-FS land is within proclaimed Forest boundary. Off-Forest is outside the proclaimed Forest boundary.

Status of Spotted Owl Critical Habitat

The Standards and Guidelines for the Northwest Forest Plan (USDA & USDI 1994a: A-3) state:

> "The Fish and Wildlife Service may review and revise its critical habitat designation for the northern spotted owl, based upon the provisions of these standards and guidelines. In the interim, the combination of, and standards and guidelines for, Late-Successional Reserves, Managed Late-Successional Areas, Riparian Reserves, and matrix, should allow critical habitat to perform the biological function for which it was designated. Any site-specific considerations of critical habitat in the matrix are considered [to be] minimal and will be evaluated through watershed analysis and addressed in area-specific plans, as appropriate."

In its biological opinion of the Northwest Forest Plan (USFWS 1994:21), the Fish and Wildlife Service used four "measures of comparison" to evaluate whether or not the Late-successional Reserves and Managed Late-successional Areas, and other protective measures, would "adequately perform the biological function identified for critical habitat." These were:

1. the gross acreage provided,
2. the degree of overlap between the two designations,
3. the distribution of reserve units to maintain a well distributed population of owls on Federal lands, and
4. the ability of the two designations to provide for dispersal between adjacent areas.

Critical Habitat Units in the Action Area

The designated function of the Critical Habitat Unit (CHU) OR-16 that is affected by the proposed activities is detailed in Table 9.

Table 9. Designated functions of Critical Habitat Units that overlaps the action area.

OR-16	This critical habitat unit (CHU) was designated to maintain and provide essential NRF habitat. Unit OR-16 is located in an area of minimal north-south CHU connectivity within the Oregon Western Cascades Physiographic Province and links units OR-14 and OR-15 in the north to units OR-18 and OR-17 to the south. Unit OR-16 includes the H J Andrews Experimental Forest which contains the Central Cascades Study Area and some of the largest blocks of suitable habitat in this province. Unit OR-16 provides a major north-south link within the Western Cascades Physiographic Province with the northern portion incorporating the Santiam Pass area of concern which helps maintain the range-wide distribution of nesting habitat for the spotted owl. About 23% of this CHU overlaps with LSRs RO215 and RO217.

The current status of the CHU OR-16 within the Willamette National Forest that is affected by the proposed activities is shown in Table 10.

Table 10. Status of Critical Habitat Unit (CHU) OR-16, Willamette National Forest ownership.

NSO Habitat	Acres	% of Total	% of Capable*
suitable	52,806	55%	62%
dispersal	14,207	15%	17%
non-habitat	28,258	30%	
Total Acres	95,270		
Total Capable Acres in CHU OR-16 in WNF ownership = 85,084			

The current status of the CHU OR-16 that overlaps the analysis area is shown in Table 11.

Table 11. Critical Habitat Unit (CHU) OR-16 within the Bridge Thin project analysis area

NSO Habitat	Acres	% of Total	% of Capable*
suitable	8,664	54%	60%
dispersal	3,371	21%	23%
non-habitat	4,019	25%	
Total Acres	16,054		
Total Capable Acres in CHU OR-16 in WNF ownership intersecting the analysis area = 14,523			

The known owl sites within CHU OR-16 are shown in Table 12. There are five owl sites within the action area with home ranges that overlap CHU OR-16. Two of these sites MSNOs 0104 and 2034 are below optimal suitable acre levels; the remaining three owl sites MSNOs 0029, 2422, and 2836 are not below optimal suitable habitat acre levels as shown in Table 8.

Table 12. Known northern spotted owl sites within the entire CHU OR-16 and owl sites that overlaps the analysis area.

Known sites within the entire CHU	Known sites within CHU that overlaps analysis area	Predicted sites	Total Sites
57	12	0	57

Late Successional Reserves (LSR)

LSRs RO217, RO218 and 100-acre LSRs occur within the action area. None of the Bridge Thin proposed activities are in these LSRs so there would be no habitat effects.

There is an expectation that owl populations would be self-sustaining where the land area (assumed to be habitat-capable land area) in individual LSRs is at least 60 percent owl habitat (Lint et al.1999). Both of the LSRs that occur within the action area are above 60 percent suitable habitat.

IV. Effects of the Proposed Action

Direct and Indirect Effects of Habitat Modification

The removal of suitable habitat has an indirect effect on northern spotted owl populations by reducing the amount of potential nesting and foraging habitat. These effects on a local owl population are greater when the amount of suitable habitat remaining post-harvest is limited in the area. Loss of nesting structure may reduce the number of breeding pairs if other nesting habitat is limited. Loss of foraging habitat could reduce the amount of food available to nearby adult and juvenile owls, which could affect their survival if other foraging options are limited.

Some habitat modification activities reduce the quality of suitable or dispersal habitat while retaining the structural characteristics of the affected stand that still allow it to support its original function. This generally includes a reduction in canopy cover to approximately >60 percent in suitable habitat and >40 percent in dispersal habitat, when other habitat elements (including snags, down wood, tree-height class-diversity, and older hardwoods) are retained, post-harvest, at levels that provide for the original function of the stand. The administrative unit biologist is responsible for ensuring prescriptive activities account for these structural elements and making correct effects determinations for each site-specific action. Since the functionality of the habitat is retained, the impacts on the ability of spotted owls to nest, forage or move across the landscape are anticipated to be insignificant.

In all cases, timber harvest within a spotted owl home range during the critical breeding season may adversely affect the reproductive capability of individual nesting owls within the disruption distance (see Table 1, page 3).

Modification of unoccupied suitable habitat is expected to have less of an impact on spotted owls because no individual spotted owls would be directly affected by the treatments and because the function of these stands would be retained, thus limiting any indirect effects.

There may also be short and/or long-term beneficial effects associated with habitat modification, particularly thinning in reserves, when they are designed to encourage faster development of late-successional characteristics. Thinning within non-matrix lands is implemented to increase growth rates and crowns by reducing competition for the retained trees, to make currently unsuitable nest trees and trees of marginal habitat quality become suitable nest trees sooner than without treatment. These thinning treatments also encourage currently suitable trees to maintain full crowns and branch development, and to create holes and gaps in the stand that will increase stand complexity and improve habitat by creating greater stand diversity for northern spotted owls and their prey base. In some cases, a short term adverse affect to the owl by light to moderate thinning may result in a long term benefit by providing structural diversity and limiting the amount of times active management (e.g., thinning) occurs in these stands.

Treatments of dispersal habitat that result in non habitat would not occur within 200 meters or 0.5 miles of known owl activity centers. Table 13 and Table 14 show proposed treatments within 0.5 miles and 1.2 miles of activity centers within the action area that would maintain dispersal habitat conditions (light/moderate thin) and remove (heavy thin).dispersal habitat in the short term.

Table 13. Treatment within 0.5 miles of activity centers within the action area.

MSNO	treatment	suitable	dispersal	non-habitat	Grand Total
2443	Light/Moderate Thin	0	20	0	20
2836	Light/Moderate Thin	0	158	0	158
Grand Total		0	178	0	178

Table 14. Treatment within 1.2 miles of activity centers within the action area

MSNO	treatment	suitable	dispersal	non-habitat	private	Grand Total
0029	Heavy Thin	0	13	0	0	13
	Light/Moderate Thin	0	79	0	0	79
0104	Heavy Thin	0	129	0	0	129
	Light/Moderate Thin	0	223	16	0	223
0856	Light/Moderate Thin	0	147	2	0	147
2034	Light/Moderate Thin	0	56	0	0	56
2422	Light/Moderate Thin	0	99	0	0	99
2443	Light/Moderate Thin	0	335	0	0	335
2836	Heavy Thin	0	96	0	0	96
	Light/Moderate Thin	0	412	0	0	412
	Fuels ReductionLt/Mod Thin	0	6	0	0	6
Grand Total		0	1594	18	0	1594

Post-treatment habitat acres are shown in Table 15 for owl home ranges in the action area. **The Bridge Thin Project does not propose to remove any suitable spotted owl habitat.** In addition, treatments of dispersal habitat that result in non habitat would not occur within 200 meters or 0.5 miles of known owl activity centers.

Table 15. Habitat in Spotted Owl Home Ranges (1.2 miles) within the Action Area after proposed treatment

MSNO	Habitat after treatment	Matrix land	Adaptive Management Area	Late Successional Reserve	NonFS land	Off-Forest	Grand Total	Suitable Habitat % of Total
0029	suitable		1,210	288			1,498	52%
	dispersal		651	74			725	
	non-habitat		666	7			672	
0029 Total			2,527	369			2,895	
0104	suitable		634	141	1		776	27%
	dispersal		619	91	0		710	
	non-habitat		1,138	1	0		1,140	
	other agency		0		223		223	
	private		0		46		46	
0104 Total			2,391	233	271		2,895	
0856	suitable		506	95	5		606	21%
	dispersal	2	438		9		449	
	off-forest					575	575	
	non-habitat	2	553	4	26		585	
	private		8		672		680	
0856 Total		3	1,505	99	713	575	2,895	
2034	suitable		928	99			1,028	35%
	dispersal		1,089	0	0		1,090	
	non-habitat		732	3	0		735	
	private		2		41		43	
2034 Total			2,752	102	41		2,895	
2422	suitable		1,388	388			1,775	61%
	dispersal		711	30			741	
	non-habitat		371	8			378	
2422 Total			2,469	426			2,895	
2443	suitable		384	75	0		458	16%
	dispersal		742	31			773	
	non-habitat		322	2	3		327	
	private		1	1	1,335		1,336	
2443 Total			1,448	108	1,338		2,894	
2836	suitable		1,002	157			1,160	40%
	dispersal		1,005	84			1,088	
	non-habitat		642	3			645	
	private		0		2		2	
2836 Total			2,649	244	2		2,895	
Grand Total		3	15,742	1,581	2,365	575	20,266	
* Within proclaimed Forest boundary								

Effects to Suitable and Dispersal Habitat in Non Critical Habitat

The effect of habitat changes are evaluated at three scales: a) nest patch area within 200 meters of activity center; b) core nesting area-0.5 miles of activity center; and c) nesting home range-1.2 miles of activity center. **The Bridge Thin project does not propose to remove or downgrade suitable spotted owl habitat**. The pretreatment habitat conditions for the owl territories within the action area are given in Table 8. The post-treatment habitat conditions for these owl territories are given in Table 15.

U. S. Fish and Wildlife Service recommends that spotted owl nest territories should average at least 50% suitable habitat in the core nest area and at least 40% suitable in the nest territory to avoid significant impact to the functionality of the home range and reproduction success of the pair to contribute to the population.

Rock Quarry Operation The existing rock quarry (unit 41) would have blasting, crushing and rock hauling occurring. This area is currently non habitat and would remain as such for the foreseeable future. The rock quarry operation will have **no effect on spotted owls.**

Road Reconstruction Roads would be cleared of vegetation, restored to grade and surfaced as needed for log or rock hauling. Road reconstruction would occur inside and outside of a CHU. No habitat would be modified therefore road reconstruction would have **no effect on spotted owls.**

Heavy Thin Big Game Forage in dispersal habitat within units (40, 42, 43, 44, 45 and 68) would enhance big game forage production on 227 acres. The post canopy closure of these seven stands could be as low as 30 percent but are expected to recover quickly (7-10 years) to the 40 percent threshold that would provide for owl dispersal, given the fast growing age of the trees. The 227 acres of Heavy Thin falls within three owl home ranges MSNO (0029, 0104, and 2836). As shown in Table 13 and Table 14, MSNO 0104 is currently below recommended levels of suitable habitat within the 0.5 mile nest core and 1.2 mile home range with suitable acres at 40% and 27% respectively. The removal of 129 acres of dispersal habitat within the home range of MSNO 0104 is **not likely to adversely affect spotted owls.** Two seasons of operation are expected for the heavy thinning.

Unit 80 (10 acres) proposes to create a big game forage area by reducing canopy closure to as low as 30 percent and maintaining the open under story through hand removal of unwanted vegetation and repeated under burning. The stand is currently functioning as dispersal habitat and is not within any known spotted owl home ranges. The over story trees are expected to achieve large diameters very quickly as there would be less competition from other trees. This legacy building feature of large trees is a positive for owls however, the multi-storied canopy and under story structure would be lacking with this park-like objective at least for the first several decades. Dispersal habitat is not limiting within or between spotted owl home ranges in the action area and therefore the unit 80 big game enhancement project is **not likely to adversely affect spotted owls.**

Light to Moderate Thinning is proposed within 1774 acres of dispersal habitat. Functionality of habitat will be maintained because the post treatment stands will have a canopy of at least 40 percent, which will provide cover and perch sites for dispersing owls; retention of snags, especially large diameter snags; retention of down wood across all condition classes: and retention of hardwoods. These are all elements positively associated with dispersal habitat and spotted owl use. The 1357 acres of light to moderate thinning in dispersal habitat falls within seven owl home ranges as shown in Table 13 and Table 14. Seven hundred and sixty one acres are proposed for light to moderate thinning within MSNOs 0104, 0856, 2034 and 2443 which are currently below recommended levels of suitable habitat within the 0.5 mile nest cores and 1.2 mile home ranges. With a 40% post harvest canopy closure maintained, light to moderate thinning of dispersal habitat within these four habitat deficient home ranges, are **not likely to adversely affect spotted owls.** Two seasons of operation are expected for the light to moderate thinning

Regeneration Savanna Restoration in dispersal habitat within units 84, 85, 86 and 89 would treat 18 acres of non suitable and 38 acres of dispersal habitat by changing a small portion of the McKenzie River / Elk Creek 6th field watershed from the current coniferous forest to its pre-settlement condition of open savanna with scattered Douglas-fir, and Oregon white oak, with a variably dense grass understory. The current overstocked condition in the Savanna Restoration project area is a result of fire suppression. The regeneration of 38 acres of dispersal habitat for oak savanna restoration would result in a post treatment canopy closure of less than 40 percent for the foreseeable future. This restoration activity is not within any known owl home ranges. Furthermore, dispersal habitat is not limiting within or between spotted owl home ranges in the action area and therefore is **not likely to adversely affect spotted owls.**

Helicopter Yarding It is assumed that a type I helicopter will be used to yard logs from the unit to the log landings. Helicopter yarding is planned for units 1,2,4,5,6,13-18,26,29-31,56,57,59,63,84, 85 and 88. No habitat will be modified with the helicopter use and therefore will have **no effect on spotted owls.**

Log and Rock Haul Log trucks would transport logs from the unit to the mill and rock trucks would transport rock to reconstruction sites. No hauling would occur within 35 yards of a known nest site. Spotted owls rarely nest at or immediately adjacent to road or edges (Kerns et al. 1992, Perkins 2000), further reducing the likelihood that hazard trees, culvert replacement and road realignments may affect nesting spotted owls. Log and rock haul associated with this project is **not likely to adversely affect spotted owls.**

Fuel Reduction/Light to Moderate Thinning in Suitable Habitat

Suitable Habitat: Functionality of suitable habitat will be maintained because the post treatment stand will have a canopy of at least 60 percent, a relatively high canopy closure; retention of snags, especially large diameter snags; retention of down wood across all condition classes: and retention of hardwoods. These are all elements positively associated with habitat function that facilitate high prey densities and therefore spotted owl use.

The Bridge Thin project proposes 38 acres (units 101 and 103) of light to moderate thinning for fuels reduction in suitable habitat. Small diameter <7" material could be mechanically removed. On site shredding/chipping of material could occur as well as piling of fuels and pile burning. Ladder fuels would be reduced and could allow the stand to be protected from future loss by catastrophic wildfire. This fuels treatment ***may affect, but is not likely to adversely affect*** the spotted owl because such actions would not change the ability of the suitable habitat to function.

<u>Fuel Reduction/Light to Moderate Thinning in Dispersal Habitat</u>: One hundred and forty two acres of fuel reduction thinning is planned in dispersal habitat. Small diameter <7" material could be mechanically removed with on site shredding/chipping of material as well as piling of fuels and pile burning. This fuel reduction treatment would not change the ability of the stands to function as dispersal habitat. Functionality of habitat will be maintained because post treatment the stand will have a canopy of at least 40 percent, which will provide cover and perch sites for dispersing owls; retention of snags, especially large diameter snags; retention of down wood across all condition classes: and retention of hardwoods. These are all elements positively associated with dispersal habitat function and spotted owl use and therefore, these treatments are **not likely to adversely affect spotted owls**.

<u>Post Harvest Burning</u> Treatment of harvest generated fuels can include grapple piling, hand piling and under burning. All harvest units are further than 0.25 miles from known activity centers except for unit 60. A seasonal restriction during the critical breeding season will be in place for unit 60 to avoid disruption to spotted owls and therefore, post-harvest burning associated with this project is **not likely to adversely affect spotted owls**.

<u>Firewood Cutting</u> Firewood would be cut from decks placed during timber sale operations. Firewood cutting will occur once harvest is complete or the following season if timing does not permit. No chainsaw activity will occur within 65 yards of known owl activity centers but could occur within 0.25 miles and therefore is **not likely to adversely affect spotted owls**.

Effects to Suitable and Dispersal Habitat in non Critical Habitat

Table 16 shows the projected changes in northern spotted owl suitable and dispersal habitat in each treatment unit based on the proposed activities.

Table 16. Proposed projects in non CHU northern spotted owl suitable and dispersal habitat.

Activity	NSO Habitat and Dispersal		Acres
	PreTreatment	PostTreatment	
Heavy Thin for Big Game Forage	Dispersal	Non habitat	237
Regeneration for Oak Savanna restoration	Dispersal Non habitat	Non habitat Non Habitat	38 18
Light/Mod Thin	Dispersal	Dispersal	1774
Light/Mod Thin for fuels reduction	Suitable	Suitable	38
Light/Mod Thin for fuels reduction	Dispersal	Dispersal	140

Dispersal ability of habitat after treatment:

There are 56 acres of potential future dispersal habitat removed with the savanna restoration, by maintaining an open (less than 20%) canopy closure to restore historic savanna conditions. The 10 acres of long term forage (unit 80) would maintain a stand with dominant conifers in a park like setting but not adequate canopy closure to meet preferred habitat requirements. No known spotted owl home ranges overlap these treatments. The six big game enhancement units (227 acres) will in the short term (7-10 years) reduce canopy closures to as low as 30 percent, however these fast growing trees are expected quickly attain the 40% canopy closure threshold within a few years with the benefit of a larger tree diameter given less competition from adjacent trees.

The loss of dispersal habitat from harvest activities is not expected to produce a measurable reduction in dispersal activities or prevent dispersal between known home ranges; no landscape level barriers to spotted owls dispersal would be created (Standard D).

Effects Summary

Proposed activities within non critical habitat for the Bridge Thin project are: rock quarry development, road reconstruction, regeneration for savanna restoration, helicopter yarding, log and rock haul, fuels reduction, post-harvest burning and firewood cutting which **are not likely to adversely affect spotted owls.**

Heavy Thin for Big Game Forage in Units 40, 42, 43, 44, 45 and 68 will remove 129 acres of dispersal habitat within the home range of MSNO 0104 which is below recommended habitat levels. The removal of dispersal habitat within the home range of MSNO 0104 is **not likely to adversely affect spotted owls.**

Light to moderate thinning will treat 1357 acres of dispersal habitat within four owl sites, MSNOs 0104, 0856, 2034 and 2443, which are currently below recommended levels of suitable habitat within the 0.5 mile nest cores and 1.2 mile home ranges. With a 40% post harvest canopy closure maintained, light to moderate thinning of dispersal habitat within these four habitat deficient home ranges, are **not likely to adversely affect spotted owls.**

Critical Habitat

Critical habitat is designated to provide for the conservation and eventual recovery of the species. The primary constituent elements (PCE) of spotted owl critical habitat are those physical and biological habitat features which support nesting, roosting, foraging, and dispersal. Any activity occurring within designated critical habitat that would impact any primary constituent element, or would appreciably slow or preclude the development of any primary constituent element, at the stand scale, may affect spotted owl critical habitat. Effects to critical habitat that are discountable, insignificant or entirely beneficial, at the stand scale are unlikely to adversely affect critical habitat. Effects that exceed this level, at the stand scale, are likely to adversely affect critical habitat.

There can also be short and/or long-term potential beneficial effects to critical habitat associated with habitat modification, particularly thinning designed to encourage faster development of late-successional characteristics. Thinning within non-matrix lands is implemented to increase growth rates and crowns by reducing competition for the retained trees, to make currently non-habitat nest trees and trees of marginal habitat quality become suitable nest trees sooner than without treatment. Table 17 shows acres of proposed treatment units in critical habitat.

Table 17. Acres of Proposed Treatment in Critical Habitat Unit OR-16.

Sale Unit	Activity	NSO Habitat		Total Unit Acres	Acres of unit in CHU	MSNO
		PreTreatment	PostTreatment			
46	Light/Moderate Thin	dispersal	dispersal	41	16	0104, 2836
47	Light/Moderate Thin	dispersal	dispersal	32	32	0104
48	Light/Moderate Thin	dispersal	dispersal	17	17	0104,2422,0029
57	Light/Moderate Thin	dispersal	dispersal	15	8	2034,2836
61	Light/Moderate Thin	dispersal	dispersal	16	7	2836
63	Light/Moderate Thin	dispersal	dispersal	29	29	0029,2422
60	Light/Moderate Thin	dispersal	dispersal	24	12	2836
62	Light/Moderate Thin	dispersal	dispersal	19	19	2836
64	Light/Moderate Thin	dispersal	dispersal	42	42	2422,2836
65	Light/Moderate Thin	dispersal	dispersal	10	10	2422,2836
66	Light/Moderate Thin	dispersal	dispersal	11	11	2422,2836
Total					**203**	

Specific Effects for Suitable and Dispersal Habitat in Critical Habitat

A "*may affect, not likely to adversely affect*" determination is warranted when the effects of the proposed action on the primary constituent elements of spotted owl critical habitat at the stand scale are expected to be discountable (extremely unlikely to occur), insignificant (not measurable, detectable or able to be evaluated), or completely beneficial as identified in the Endangered Species Consultation Handbook (USFWS and NMFS 1998, USFWS 2006a).

The effect of habitat changes are evaluated at three scales: a) nest patch area within 200 meters of activity center; b) core nesting area-0.5 miles of activity center; and c) nesting home range-1.2 miles of activity center. **The Bridge Thin project does not propose to treat suitable spotted owl habitat within critical habitat**. The pretreatment habitat conditions for the owl territories within the action area are given in Table 8. The post-treatment habitat conditions for these owl territories are given in Table 15

U. S. Fish and Wildlife Service recommends that spotted owl nest territories should average at least 50% suitable habitat in the core nest area and at least 40% suitable in the nest territory to avoid significant impact to the functionality of the home range and reproduction success of the pair to contribute to the population. Table 17 shows the projected changes in northern spotted dispersal habitat in each treatment unit within critical habitat unit OR-16 based on the proposed activities

Rock Quarry Operation This project has no planned rock quarry operation within critical habitat.

Road Reconstruction Road reconstruction would clear vegetation, restore grade and road surface as needed for log or rock hauling. Road reconstruction would occur inside of CHU. No habitat would be modified therefore road reconstruction would have **no effect on spotted owls.**

Heavy Thinning for Big game enhancement This project does not plan heavy thinning activities for big game enhancement within critical habitat.

Light to moderate thinning This project proposes to thin 203 acres of dispersal habitat within critical habitat. Functionality of habitat will be maintained because post treatment the stand will have a canopy of at least 40 percent, which will provide cover and perch sites for dispersing owls; retention of snags, especially large diameter snags; retention of down wood across all condition classes: and retention of hardwoods. These are all elements positively associated with dispersal habitat.

The five owl territories with home ranges within critical habitat are: MSNOs 0029, 0104, 2034, 2422 and 2836 as shown in Tables 17. Adequate levels of suitable habitat occur within the nest patches of each of these territories. Two owl sites MSNOs 0104 and 2034 are currently below the 50% level with 40% and 49% respectively for the core nesting area. These two territories are currently below the 40% suitable level for the general nesting home range percentages of 27% and 35% respectively. The acres of suitable habitat will not change post-treatment for any of the spotted owl home ranges within critical habitat (Table 15). Sixty five acres and eight acres of light to moderate thinning in dispersal habitat are proposed in the general home ranges of MSNO 0104 and 2034, respectively, in critical habitat. The light to moderate thinning will maintain a post treatment canopy of greater than 40%. Therefore, 73 acres of light to moderate thinning in dispersal habitat **may affect but is not likely to adversely affect northern spotted owls** in MSN0 territories 0104 and 2034. Two seasons of operation are expected for the light to moderate thinning in critical habitat.

Savanna Restoration: The savanna restoration units do not occur within critical habitat.

Helicopters: It is assumed that a type I helicopter will be used to yard logs from the unit to the log landings. Two helicopter units (57 and 63) are located in a CHU. No habitat will be modified with the helicopter use and therefore will have **no effect on spotted owls.**

Log and Rock Haul: Log trucks would transport logs from the unit to the mill and rock trucks would transport rock to reconstruction sites. Log and rock haul associated with this project will not modify habitat and therefore will have **no effect on spotted owls.**

Fuels Reduction Fuels reduction by light to moderate thinning is not planned in critical habitat.

Firewood Cutting Firewood would be cut from decks placed during timber sale operations. Firewood cutting will occur once harvest is complete or the following season if timing does not permit. Firewood cutting will not result in a modification of habitat and therefore will have **no effect on spotted owls**

Dispersal ability of Critical Habitat after treatment:

Light/moderate thinning would occur in 203 acres of dispersal habitat. Dispersal capacity will be maintained by canopy closure prescriptions above 40%, as well as snag, down wood and hardwood retention. There are no known dispersal barriers between owl home ranges and no landscape level barriers to spotted owls dispersal will be created (Standard E). Additionally all proposed projects are outside any area of concern.

Effects call to Critical Habitat Unit OR-16

The Bridge Thin project proposes to treat 203 acres of dispersal habitat but will maintain the 40% canopy closure thresholds, along with preferred dispersal habitat elements including snags, down wood and hardwoods. Critical Habitat Unit OR-16 continues to function well with some of the largest blocks of suitable habitat in the province and contains 57 known owl sites. The thinning of these stands is intended to encourage faster development of late-successional characteristics by increasing tree growth rates. Therefore, the Bridge Thin project ***may effect but is not likely to affect*** Critical Habitat Unit OR-16.

Disturbance

Direct and Indirect Effects of Associated Disturbance to Northern Spotted Owls

Proposed actions that would generate noise above local ambient levels might disturb spotted owls and interfere with essential nesting, roosting, or foraging behaviors. Disturbance from proposed activities conducted within the disruption distance during the breeding period, as shown in Table 1 from an active nest, may affect, and are likely to adversely affect nesting northern spotted owls. Noise-producing activities projected for implementation during the critical breeding period (or the entire breeding period for Type I helicopters) could result in the incidental taking of spotted owls.

In the Central Cascades, 86 percent of owl young fledge (*i.e.,* leave the nest tree) by June 30 (Turner, personal comm. 1999). Based on observations (Forsman et al. 1984) that most young owls are capable of short, clumsy flights between trees within one week after fledging, it is likely that two weeks would allow sufficient development of owlets to achieve sustained flight. Therefore, the spotted owl critical period in the Willamette Province is considered to be March 1 through July 15. After July 15, it is presumed that most fledgling spotted owls are capable of sustained flight and can move away from harmful disturbances. For this reason, disturbance from the proposed actions within disruption distances of an active nest during the latter portion of the breeding period (between July 16 and September 30) may affect, but are not likely to adversely affect spotted owls, because while adverse effects are possible, they are not reasonably certain to occur.

However, disturbances associated with the use of ICS Type I helicopters[4] are considered to be of greater impact than ICS Type II – IV helicopters, due to the intensity of the noise and wind disturbance associated with rotor wash. Thus, activities requiring the use of large helicopters within disruption distances of an active nest may affect, and are likely to adversely affect nesting spotted owls during the entire breeding period (March 1 – September 30). See Table 1 for a complete listing of Disruption Distances.

Use of chainsaws within the disruption distance during the critical breeding season (March 1 – July 15) may disrupt northern spotted owl behavior and affect their ability to reproduce (USFWS 2003, 2006).

As shown in Table 1, the disruption distance for the northern spotted owl during the critical breeding period is 35 yards for use of heavy equipment, which in this case includes drilling, rock crushing, and hauling of rock. Blasting has a disruption distance of 1 mile.

In a white paper, the USFWS (2003) analyzed the research on spotted owl disturbance factors. The document states, "...we estimated these sound-only levels to be: 40 dB for the ambient sound level; 44 dB for the detect threshold; 57 dB for the alert threshold; 70 dB for the disturbance threshold; and 92 for the injury threshold."

The Willamette Province Level One Team has interpreted this information and assigned a threshold for disturbance effects calls (Table). When the sound levels reach the disturbance threshold of 70 decibels, the effects determination is *May Affect, Not Likely to Adversely Affect* Northern Spotted Owls. When the sound level reaches 92 decibels and above, the effects determination is *May Affect, Likely to Adversely Affect* Northern Spotted Owls. If sound levels are below 70 decibels, no effect is anticipated. These effects determinations are reflected in the disturbance/disruption distance charts shown in the current Willamette Province Batched Biological Assessment for Disturbance (USDA and USDI 2006) and in Table 18.

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[4] Incident Command System definitions: A Type I helicopter seats at least 16 people and has a minimum capacity of 5,000 lbs. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters. A Type II helicopter seats at least 10 people and has a minimum capacity of 2,500 lbs. Both an UH1-H and a Bell 212 are Type II helicopters. A Type III helicopter seats at least 5 people and has a minimum capacity of 1,200 lbs. Both a 206 and a Hughes 500 are Type III helicopters. A Type IV helicopter seats at least 3 people and has a minimum capacity of 600 lbs.
Kmax helicopters are considered Type I helicopters according to the ICS definition but are considered Type II for the purposes of disturbance. Sound readings from Kmax helicopter logging on the Olympic NF registered 86 decibels at 150 yards (Piper 2006). The threshold for disruption is 92 decibels.

Table 18. Effects Determination to Northern Spotted Owls by Decibel Level.

Decibel Measurement	Effect Determination
92	May Affect, Likely to Adversely Affect
70-91	May Affect, Not Likely to Adversely Affect
Below 70	No Effect

Underground drilling into rocks is expected to result in a sound level of approximately 90 dB which may affect the northern spotted owl. The effects of blasting carry further, but can vary widely depending on the actual blasting charge and surrounding terrain. Decibel levels at 0.25 mile distance may range from 90-150 dB and are of shorter duration. Rock crushing may have a noise level between 60-90 dB, depending on distance.

Proposed actions within suitable habitat with no history of an owl nest site or activity center have the potential to occur within the disruption distance of an active nest site during the breeding season. Based on density studies from the western Cascades Physiographic Province demographic study, the nest density of northern spotted owls is 0.0104 territories per km^2 or 1 territory per 2,377.15 acres (Anthony and Forsman 1997). Assuming that 50 percent of pairs breed/nest in a given year, these studies posit one spotted owl nesting pair per 4,754.3 acres. Therefore, since the proposed projects and their associated activities are scattered throughout the action area and the disturbance “foot print” of the project is only a small percent of the area associated with a potential nesting pair, without additional site specific information, it is not reasonably certain that disturbance will adversely affect a nesting pair of spotted owls. Therefore, disturbance ***may affect but is not likely to adversely*** affect spotted owls outside of occupied sites.

Disturbance from proposed actions conducted outside of the breeding period (between October 1 and February 28) or more than the disturbance distances from a nest site during any time of the year would have ***no effect*** on northern spotted owls.

Projects that may affect spotted owls due to disruption or disturbance

Rock Quarry Operation

Table 19 summarizes disturbance-related activities that are proposed. For blasting, Table 1 shows a disruption/disturbance distance of 1 mile. A known owl activity center 0104 is just within one mile from the rock pit source. One season of blasting operations is expected but there will be a seasonal restriction for project-related blasting during the critical breeding period. Therefore, this activity ***may effect but is not likely to adversely affect*** spotted owls. The disruption distances for rock crushing, pile driving, and heavy equipment are 120, 60, and 35 yards, respectively. The disturbance distance for these three activities is 0.25 miles. These mechanical activities of rock source development at the project rock pit are expected to have ***no effect*** on northern spotted owls given location of rock quarry to known spotted owl sites.

Road Reconstruction

The disruption and disturbance distances (Table 1) for the northern spotted owl for heavy equipment used in road reconstruction are 35 yards and 0.25 miles, respectively. The disruption and disturbance distances for chain saws that might be used to fall hazard trees or cut downed trees along the road ways during reconstruction are 65 yards and 0.25 miles, respectively. All known owl activity centers are more than 65 yards from road reconstruction areas so no disruptions to nesting northern spotted owls are expected. One season of operation is expected. Noise from road reconstruction may affect owls by disturbance, but, due to the distance from known nesting sites, this action ***may affect*** **but is** ***not likely to adversely affect*** northern spotted owls.

Timber Falling, Harvesting and Cable Yarding

The project design does not seasonally restrict timber harvest, including tree falling and ground based-logging. No activities are proposed during the critical breeding period within 35 yards of activity centers for heavy equipment or 65 yards of activity centers for chainsaws. Therefore, timber falling and cable yarding are **not likely to adversely affect** spotted owls.

Savanna Restoration

All savanna restoration units will have some amount of helicopter logging associated with them. There is a no seasonal restriction being recommended because there are no known owl activity centers in the vicinity of the project. The type of helicopter used is at the purchaser's discretion. Therefore in this analysis it is assumed that a Type I helicopter will be used to log these units.

Additionally, prescribed burning of this oak savanna will likely occur separately, at a different time than harvest activities. Depending on the fuels prescription, this unit may be burned during the critical breeding season. Since the disruption distance for burning during the critical breeding season is 0.25 miles (Table 1), this activity is well outside disturbance and disruption distances of known owl sites.

All other associated activities are outside the disturbance and disturbance distances for northern spotted owls. Therefore, these activities will have **no effect** to spotted owls due to disturbance. The savanna project could occur over one to three years depending on packaging of the sale units and burning conditions.

Helicopter Yarding

The disturbance distance for Type 1 helicopter-yarding is 0.5 miles (Table 1). Yarding with Type 1 helicopters between 0.25 miles and 0.5 miles of known owl activity centers during the breeding season **may affect but is not likely to adversely affect** spotted owls**.** There are six units (13, 14, 17, 56, 57 and 59) between 0.25 miles and 0.5 miles of known owl activity centers that are planned for helicopter yarding. However, there will be no helicopter activity within the disruption distance (0.25 mile) of any known site during the critical breeding period. All other helicopter yarding units are more than 0.5 miles from any known nest activity center.

Log and Rock Haul

Log haul along roads regularly used by the public is not expected to increase noise above ambient levels and should have no effect on northern spotted owls. Log haul along reconstructed roads will increase noise levels at about the same level as heavy equipment (Table 1). The risk of disturbances and disruptions to owl nest sites is similar to that discussed above for heavy equipment during road reconstruction. No other impacts to owls from log hauling are expected. Therefore, log hauling ***may affect, but is not likely to adversely affect*** northern spotted owls. Log haul could be expected to occur over three seasons depending on the timing of harvest and the decking of logs.

No hauling would occur within 35 yards of a known nest site. Spotted owls rarely nest at or immediately adjacent to road or edges (Kerns et al. 1992, Perkins 2000), further reducing the likelihood that hazard trees, culvert replacement and road realignments may affect nesting spotted owls

Fuels reduction

Small diameter <7" material could be mechanically removed with on site shredding/chipping of material as well as piling of fuels and pile burning. This fuel reduction treatment would not change the ability of the stands to function as either suitable or dispersal habitat. There are no known spotted owl activity centers within 0.25 miles of these fuel reduction units therefore, these treatments are expected to have **no effect on spotted owls**.

Prescribed Burning

The disruption and disturbance distance from burning is 0.25 miles during the critical and latter breeding periods, respectively (Table 1). Prescribed burning to treat harvest generated fuels could occur on Unit 60 which is within 0.25 miles of a known activity center.. A seasonal restriction will be in place on Unit 60 for the critical breeding season and therefore, the prescribed burning of Unit 60 ***is not likely to adversely affect*** northern spotted owls. In addition, burning may involve limited chainsaw work to clear brush and woody debris. All other timber harvest units where slash may be burned post-treatment are greater than 0.25 miles from any northern spotted owl activity center so **no effects** are expected to the species from burning logging-generated slash in these harvest units. Prescribed burning could occur over two seasons if weather is not favorable.

Firewood Cutting

Firewood would be cut from decks placed during timber sale operations. Firewood cutting will occur once harvest is complete or the following season if timing does not permit. No chainsaw activity will occur within 65 yards of known owl activity centers but could occur within 0.25 miles and therefore is ***not likely to adversely affect spotted owls***

A summary of disturbance determinations by activities as discussed above are summarized below in Table 19.

Table 19. Summary of Disturbance-Related Effects Determinations to Northern Spotted Owls by Activity.

Activity	MSNOs affected	Number of Seasons affected	Effect Determination
Rock Quarry Operations	0104 , 2836	1 Seasonal restriction during critical breeding	May Affect, Not Likely to Adversely Affect.
Road Reconstruction	0029,0104,0856,2034,2422, 2443,2836	1	May Affect, Not Likely to Adversely Affect
Heavy Thin of Dispersal for Big Game forage Enhancement	0029, 0104, 2836	2	May Affect, Not Likely to Adversely Affect
Light/Moderate Thinning of Dispersal	0029,0104,0856,2034, 2422, 2433,2836	2	May Affect, Not Likely to Adversely Affect
Regeneration Harvest of Dispersal for Oak Sananna Restoration	None	3	No Effect
Helicopter Yarding between 0.25 and 0.5 miles	2836,2443	1	May Affect, Not Likely to Adversely Affect
Log Haul	0029,0104,0856,2034,2422, 2443,2836	3	May Affect, Not Likely to Adversely Affect
Fuels reduction Lt/Mod Thin	None within 0.25 miles	1	No Effect
Post Harvest Burning	2836 (unit 60 within 0.25 miles)	2 Unit 60 will have seasonal restriction during critical breeding season	May Affect, Not Likely to Adversely Affect
Firewood Cutting	None within 65yds	3	May Affect, Not Likely to Adversely Affect

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this biological assessment. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

While the U.S. Fish and Wildlife Service, BLM and U.S. Forest Service do not have the authority under the ESA to affect private actions, cumulative effects analysis of foreseeable State and private actions provide the federal agencies greater insight toward understanding the current environmental baseline and likely trends. This insight is necessary to provide the federal agencies with a broader context in which to fully evaluate the impact of the Federal action.

Habitat for spotted owls has not been comprehensively classified or surveyed on state or private lands. Most lands, including the larger state and private timber company holdings, have been harvested within the past 50 years, and are now in shrub, pole, or large pole condition classes. Some mature forested stands exist on county, state, or private land, but these stands represent a small proportion of non-federal land ownership. The mature stands provide limited amounts of suitable habitat for listed forest species. Mature and large pole stands are presently being logged at an accelerated rate due to present economic conditions. This trend is expected to continue into the foreseeable future.

The majority of late successional/old-growth forests on state and private land in Washington, Oregon, and Northern California are used for timber production (Thomas *et al.* 1990; USDA and USDI 1994b). Historically, non-federal landowners have practiced even-aged management (clear cutting) of timber over extensive acreage. Given current market conditions, it is reasonable to assume that these past management practices are likely to continue, thereby reducing the amount of suitable habitat for spotted owls on non-federal lands over time. Before the spotted owl was listed as a threatened species under the ESA, Thomas *et al.* (1990) estimated that most non-federal spotted owl habitat in Oregon would be eliminated within 10 years. Although the trend to harvest continues, not all non-federal owl habitat was harvested during the 1990s. Hence, harvest activities on non-federal lands can be expected to continue to impact spotted owls located within adjacent Federal lands through the continued reduction and fragmentation of habitat.

It is generally recognized that Federal lands will make significant contributions to the recovery of spotted owls through implementation of the NWFP. However, non-federal lands are important where Federal lands are absent or where suitable habitat on Federal lands is believed insufficient to maintain local populations or, in the case of the spotted owl, provide demographic support across and between physiographic provinces (Thomas *et al.* 1990). While contributions on all non-federal land may not be critical across the range of these species, contributions in certain regions may provide demographic support to Late-successional Reserves which are not yet fully functional and providing necessary connectivity between Late-successional Reserves.

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Bridge Thin Wildlife Biological Evaluation

File Code:	2670 T, E, and S species	**Date:**	18 January 2008
Route To:	Project File		
Subject:	Terrestrial Fauna Biological Evaluation (BE) for: Bridge Thin Project		

SUMMARY OF DETERMINATIONS

Determinations:

The following summarizes effect or impact determinations to species currently listed as threatened, endangered, or sensitive (TES) that may have suitable habitat identified, and have either documented or suspected occurrence within the project area. **There are no recognized effects or impacts to TES species from No Action.**

Activities associated with the proposed project **may affect, but are not likely to adversely affect** the northern spotted owl. A full discussion of affects can be found in the Biological Assessment dated January 10, 2008 that was submitted to U S Fish and Wildlife Service.

Activities associated with the proposed project should have **no impact** on individuals of the following regionally listed sensitive species or their habitat:

- **Peregrine Falcon**
- **Wolverine**
- **Pacific Fringe-tailed Bat**
- **Crater Lake Tightcoil**

Cumulative effects of this project in conjunction with other reasonably foreseeable projects in and adjacent to the project area are not expected to jeopardize the continued existence of any TES species as a result of modification of their essential habitat; nor would they likely contribute to a trend towards Federal listing or cause a loss of viability to populations of species designated as R-6 Sensitive or as Management Indicator Species on the Willamette National Forest. Maintenance and/or recovery of late successional habitat serving as current or potential dispersal corridors surrounding the project area will ensure ongoing opportunities for occupancy and movement of terrestrial TES wildlife species that may occur in the vicinity of this project and are dependent on such habitat.

SUMMARY OF SEASONAL RESTRICTIONS/RECOMMENDATIONS

Implementing the following recommendations would ensure effects or impacts on listed species from proposed activities would be no greater than those addressed in this document, and also would mitigate those impacts.

Spotted Owl

- Impose seasonal restriction on activities associated with project that generate above-ambient noise levels during the spotted owl critical nesting period between March 1 and July 15.

Pacific Fringe-tailed Bat

- Protect decadent trees and snags >12"dbh (roosting habitat) within the project area to the greatest extent feasible while conducting restoration activities.

Crater Lake Tightcoil

- Ensure that measures identified to prevent habitat disturbance within 10 meters of perennially wet areas are implemented during project activities.

Introduction

This document addresses potential effects to proposed, threatened, endangered or sensitive (TES) fauna listed in the Region 6 Regional Forester's Federally Listed or Proposed, and Sensitive Species Lists (dated July 21, 2004) with documented or suspected occurrences on the Willamette National Forest from activities associated with a habitat restoration project. Biological evaluations of the potential effects to threatened, endangered and sensitive fish and flora are in separate documents prepared by this project's Fish Biologist and Botanist. This evaluation, required by the Interagency Cooperative Regulations (Federal Register, January 4, 1978), ensures compliance with the provisions of the Endangered Species Act (ESA) of 1973, P.L. 93-205 (87Stat. 884), as amended. A review of potential effects to non-TES wildlife species from this project proposal is presented in a separate Wildlife Specialist Report.

Project Location and Description

The McKenzie River Ranger Districts proposes to harvest timber on approximately 2256 acres of the Bridge Thin Project Area, which would yield an approximate net estimate of 35.6 million board feet (MMBF) of wood products. This proposal, represented in Alternative B in this EA, would include heavy thinning on 1458 acres, moderate thinning on 398 acres, oak savanna restoration on 51 acres, wildlife forage thinning on 190 acres and fuels treatment on 178 acres. The timber sales from this proposal would likely occur over a four year time span, beginning in fiscal year 2009.

The project is located on the McKenzie River Ranger District, Willamette National Forest, Lane County, Oregon. The legal location of the project is WM T15S R4,5 E, and T16S R4,5E. The Willamette National Forest Land and Resource Management Plan shows land allocation in the project area as: 5a- special interest area, 7- Old growth Groves, 9c- Wildlife marten Area, 9d- Special Wildlife Habitat Area, 11a-Scenic Modification Middleground, 11c- Scenic Partial Retention Middleground, 11e-Scenic Retention Middleground, 11f- Scenic Retention Foreground, 14a-General Forest, 16a-Late Successional Reserve, and 17-Adaptive Management Area.

Alternatives:

The Bridge Thin Project will be analyzed in an Environmental Assessment that reviews three alternatives – a No Action alternative and two Action Alternatives. The Action Alternatives involve activities described above.

Action Alternative: The influence of proposed activities on terrestrial wildlife is considered in the context of whether or not suitable habitat may be modified or if a species may be present at or near sites where physical disturbance may occur, or be sensitive to and thereby influenced by anthropogenic activities occurring during implementation of this project. Habitat disturbance that may affect some terrestrial wildlife species could occur as a result of this project. That potential is addressed later in this report.

No Action Alternative: There is no rationale to suggest the No Action alternative would affect or impact any terrestrial wildlife species based on their ecological requirements and current habitat conditions in the project area. Considering the No Action Alternative would have no effect/impact on terrestrial wildlife species is based on the following assumption - taking no action would not affect current habitat or wildlife species that may be present as either evolves without human management. The dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. Only potential effects or impacts of the Action Alternative will be discussed further in this document.

WATERSHED ANALYSIS / ADDITIONAL DOCUMENT SUPPORT

Proposed activities respond positively to recommendations made to address vegetation and wildlife in the Quartz Creek and Minor Tributaries Watershed Analysis.

MANAGEMENT DIRECTION COMPLIANCE

The alternative selected for management of the Willamette National Forest includes a strategy that provides Management Requirements (MRs) exceeding the minimum MRs established for Management Indicator Species (MIS) as presented in the Willamette Forest Plan FEIS Appendices - Volume 1 (USDA 1990, pp B-79 through 82). Maintenance of the MRs ensures the viability of MIS and the species they represent. The MRs have been further enhanced for most MIS species (i.e. those species dependent on old growth and mature conifer habitat, and dead and defective tree habitat) under the Forest Plan S&Gs as amended by the Northwest Forest Plan.

Proposed action associated with this project complies with current forest Standards and Guidelines (S&Gs) pertaining to MIS and other rare and uncommon species management. This proposal also complies with other S&Gs established in the Willamette National Forest Land and Resource Management Plan (1990) as amended by the Northwest Forest Plan Records of Decision (ROD) (1994, 2001, and 2004).

TES SPECIES – REVIEW AND ASSESSMENT

The Biological Evaluation (BE) is a 6-step process that identifies known or suspected threatened, endangered, and sensitive (TES) or Proposed wildlife species that may be associated with a project area, and evaluates impacts the project may have to those species. The six steps are as follows:

1. Prefield review of existing information.
2. Field reconnaissance of the project area to document evidence of a species or habitat.
3. Assessment of whether known or suspected populations of TES or Proposed species will be affected by the project.
4. Analysis of the significance of the project's effects on local and entire populations of TES or Proposed species.
5. If step 4 cannot be completed due to lack of information, a biological investigation is done.*
6. Conferencing or informal/formal consultation with the U.S. Fish & Wildlife Service (USFWS) is initiated at appropriate stage as outlined in FSM 2673.2-1, or is otherwise arranged through formal channels.

* Step 5 pertains only to listed species and will not be indicated except when applicable.

A summary of ecological requirements for Federally listed[1] or proposed[2] species, and animal species on the Regional Forester's Sensitive Species List[3] for species with documented or suspected occurrence in the the Willamette National Forest is displayed in Table 1.

A summary of the BE process showing **effects determinations**[4] for Federally listed or proposed species, and **impact determinations**[5] for animal species on the Regional Forester's Sensitive Species List for species with known or potential occurrence in the project area is displayed in Table 2.

1 Species listed based on the USDA Forest Service Pacific Northwest Region Federally Listed or Proposed Species list (updated 7/21/04) having documented or suspected occurrence on the Willamette National Forest.

2 When a species is proposed for listing under the Endangered Species Act of 1973 (with amendments), a notice is published in the Federal Register, a daily publication of the Federal Government. The Federal Register is available on the internet at the following site: http://www.access.gpo.gov/nara/nara005.html

3 Species listed based on the USDA Forest Service Regional Forester's Sensitive Animal List (updated 7/21/04) (USDA 2004a,b) having documented or suspected occurrence on the Willamette National Forest.

4 The criteria for effects determinations can be found in the *Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences* (USFS and NMFS 1998).

5 Impact determinations are required for all species listed under the Regional Forester's Sensitive Species List (Forest Service Manual 2670.32, 2670.5). Direct, indirect, and cumulative effects should be considered. For a discussion of cumulative effects analysis, see the document *Considering Cumulative Effects under the National Environmental Policy Act* (Council on Environmental Quality 1997).

Table 1. Summary of Ecological Requirements for Animal Species on the Regional Forester's Federally Listed and Sensitive Species Lists for species with documented or suspected occurrence on the Willamette National Forest (July 21, 2004).

Species	**Habitat**
Northern Spotted Owl ***Strix occidentalis*** ***Status: Federally Threatened***	Occur primarily in the interior of older timber stands with structure required for food, cover, nest sites, and protection from weather and predation. Reproductive habitat = forest w/ canopy closure 60 – 80%; multi-layered, multi-species canopy dominated by large overstory trees (> 30"dbh); abundant large trees w/deformities (e.g. large cavities, broken tops, dwarf-mistletoe infections, decadence); abundant large snags/down logs; and sufficient open flying space below the canopy. Foraging habitat = forest w/ > 2 canopy layers; overstory trees > 21" DBH; abundant snags/down wood; and a 60-80% canopy closure. Dispersal habitat = forest w/ > 11" DBH trees and > 40% canopy closure. Numerous sightings and occupied territories recorded on the McKenzie River RD.
Northern Bald Eagle ***Haliaeetus leucocephalus*** ***Status: Federally Threatened***	Use scattered old-growth conifer trees in proximity to open water near rivers, lakes, and reservoirs with plentiful prey. Feed primarily on fish, but will also eat waterfowl and carrion. On the McKenzie River RD, they currently nest at Blue River Reservoir, and activity observed at Clear Lake and Lost Lake.
Least Bittern ***Ixobrychus exilis***	Freshwater or brackish marshes with tall vegetation. Stalks through the weeds to find prey. Eats small fish, frogs, insects, small mammals, and sometimes bird eggs and chicks. Nests are small platform of sticks and live or dead vegetation, placed in cattails, bulrushes, or bushes 8-14" above water. Sightings of individuals at Fern Ridge and Salem. No confirmed sightings on the McKenzie River RD.
Bufflehead ***Bucephala albeola***	Summers on wooded lakes and rivers, winters on lakes and coastal waters. Nesting normally occurs near lakes in tree cavities 5-50 feet high. Dives underwater and eats small mollusks, fish, snail, and crustaceans. Also eats aquatic insects. Winter sightings common along reservoirs, and nesting activity suspected at sites associated with numerous high elevation lakes on the McKenzie River RD.
Harlequin Duck ***Histrionicus histrionicus***	During nesting (April-June) adults require fast-flowing water with midstream loafing sites nearby, dense shrub or timber/shrub mosaic vegetation on the bank, and an absence of human disturbance. Nest on ground under the shelter of vegetation, rocks, or large woody debris in close proximity to water. Broods prefer low gradient streams with adequate macro invertebrate abundance. Breeding and foraging known to occur along portions of the Main stem and South fork of the McKenzie River .

American Peregrine Falcon ***Falcon peregrinus anatum***	Preferred nesting sites are sheer cliffs 75 ft. or more in height having horizontal ledges or small caves. Foraging is associated with a variety of open and forested habitats, however is most closely associated with riparian settings. Numerous potential nest sites and occupied territories occur on the McKenzie River RD.
Yellow Rail ***Coturnicops noveboracensis***	Feeds in shallow water, eating snails, insects, and some seeds and grasses. Summers on wet meadows, marshes; winters on grasslands, fields, and coastal marshes. No documented occurrence in potential habitat on McKenzie River RD.
Black Swift ***Cypseloides niger***	Found near wet cliffs in mountainous regions. Feeds on-the-wing eating flying insects. Nests in small colonies on ledges or mountain crevices associated with waterfalls. There are historical summer records in the Santiam Pass area, Linn County, which suggests breeding in that area.
Baird's Shrew ***Sorex bairdii permiliensis***	Poorly understood but generally considered a non-riparian associate. In 1986 two specimens were trapped from an open Douglas-fir forested area with numerous rotting logs in Polk Co. It has also been trapped on McKenzie River RD in the Mill Creek area and in the Blue River watershed.
Pacific Shrew ***Sorex pacificus cascadensis***	Poorly understood, but considered a riparian associate generally found in moist areas along class III-IV streams with abundant vegetation and down material. Occasionally found in adjacent conifer forest with moist abundant decaying logs and brush. Nests made of grasses, mosses, lichens, or leaves. Feed on slugs, snails, insects, and sometimes vegetation. No known locations on McKenzie River RD.
Pacific Fisher ***Martes pennanti***	Considered a riparian associate but found in a wide variety of densely forested habitats at low to mid-elevations. Diet consists of small and medium-sized forest mammals (porcupines, snowshoe hares, tree squirrels, mice, and voles most common). Also eat carrion, and will seasonally eat birds, bird eggs, amphibians, fish, and insects. Use ground burrows, tree cavities, witches brooms or other clumped growth, or occasionally bird or small mammal nests as resting sites. Tree cavities are used by most maternal females with young and ground burrows are used mostly in winter. Data suggests they do better in areas with minimized fragmentation of old growth, second-growth, and riparian area and in areas with abundant down and standing woody material important. A few sightings recorded on the McKenzie River RD.
California Wolverine ***Gulo gulo***	Found primarily in wilderness or remote country where human activity is limited. High elevation areas appear to be preferred in summer, which may effectively separate wolverines and intensive human disturbance in most areas. In winter wolverines may move to lower elevations that are snowbound and/or have very limited human activity. They are capable of foraging widely (30-40 km) on a daily basis, and do not significantly use young, dense stands of timber or clearcuts. The majority of activity occurs in large expanses of scattered mature timber, with some use of ecotonal areas such as small timber pockets, and rocky, broken areas of timbered benches. Heavy use of openings w/ good winter populations of big game, a principal source of carrion which makes up much of the wolverine's diet. They also feed on marmots, snowshoe hares, various rodents, insects, insect larvae, eggs, and berries. Several unconfirmed observations mostly in wilderness areas.
Pacific Fringe-tailed Bat ***Myotis thysanodes vespertinu***	Occurs in Oregon, however habitat use is poorly documented. Three captured in 1971 were associated with young coniferous forest. They are known to use caves, mines, rock crevices, and buildings as both day and night roosts. Nothing is known about habits in winter. Diet of moths, leafhoppers, lacewings, daddy-loglegs, crickets, flies, true bugs, and spiders. Occurrence has been documented on McKenzie River RD.

Oregon Slender Salamander ***Batrachoseps wrighti***	Live in forested areas, especially old-growth Douglas-fir and younger stands with abundant downed large logs. They lay their eggs under thick bark, inside a crevice in a log, or in talus. Juveniles and adults live under thick bark, inside partially decayed logs, or in debris piles around the bases of large snags. They also occur in moist talus w/ abundant woody debris. Sightings have been documented at lower elevation sites on McKenzie River RD.
Cascade Torrent Salamander ***Rhyacotriton cascadae***	Live in very cold, clear springs, seeps, headwater streams, and waterfall splash zones. Forage in moist forests adjacent to these areas. Eggs are laid in rock crevices in seeps. Larve and adults live in gravel or under small cobbles in silt-free, very shallow water that is flowing or seeping. Adults may be found under debris on streambanks or in streamside forests and talus during rainy periods. Documented in the Blue River landscape area.
Foothill Yellow-legged Frog ***Rana boylii***	Live in sections of low-gradient streams with exposed bedrock or rock and gravel substrates. Attach eggs to the bottom of quiet scour-pools or riffles in gentle-gradient streams, often where there is only slight flow from the main river. Hatchlings cling to egg masses initially and then to rocks. Nearest known sightings are on private lands adjacent to the Sweet Home RD to the north.
Oregon Spotted Frog ***Rana pretiosa***	Favor lakes and slow moving streams associated w/a permanent water source w/ a soft and muddy bottom. A marsh specialist w/strong preference/requirement for warmer waters; more aquatic than other ranids; often found in water or water's edge floating on the surface or resting on aquatic vegetation. Diet is invertebrates caught above and below the surface. Early breeders: egg masses are typically deposited on top of one another in a communal fashion, not attached to vegetation, and deposited in warmer shallow water, making them susceptible to mortality due to freezing or drying. Documented populations on the McKenzie River RD in the Mink Lake basin area of the Three Sisters Wilderness.
Northwestern Pond turtle ***Clemmys marmorata marmorata***	Inhabit marshes, sloughs, moderately deep ponds, slow moving portions of creeks and rivers. Observed in altered habitats including reservoirs, abandoned gravel pits, stock ponds, and sewage treatment plants. Occur from sea level to about 1,830 meters. Require basking sites, such as partially submerged logs, vegetation mats, rocks and mud banks, and may even climb a short way onto tree branches that dip into the water. They use uplands for egg laying, overwintering, and dispersal. They may move up to 500 meters and possibly more for overwintering where they burrow into leaf litter or soil. Nest distances from the water course ranges from 3 meters to over 402 meters. Sparse vegetation, usually short grasses or forbs characterize most nesting areas. Documented sites along McKenzie River on private ground.
Mardon Skipper ***Polites mardon***	A small, tawny-orange butterfly currently known to exist at seven, small, geographically disjunct areas in Washington, Oregon, and California. In the southern Washington Cascades, the mardon skipper is found in open, fescue grasslands within Ponderosa pine savanna/woodland habitat at elevations ranging from 1900' to 5100'. South Cascade sites vary in size from small, ½ acre or less meadows, to large grassland complexes, and site conditions range from dry, open ridgetops, to areas associated with wetlands or riparian habitats. Within these environments a variety of nectar source plants are important. The short, open stature of native fescue bunchgrass stands allows mardon skippers to access nectar and oviposition plants. There are no known populations of this species on the Willamette NF.

Crater Lake Tightcoil ***Pristiloma arcticum crateris***	Species may be found sparsely distributed throughout Oregon Cascades above 2000' elevation associated with perennially wet environment in mature conifer forests and meadows among vegetation or under rocks and woody debris. Suitable locations within 10 meters of open water generally in areas under snow for extended periods during winter. One documented site on Middle Fork RD along with a few sites on Mt Hood, Deschutes, Umpqua, Winema, and Rouge River National Forests. No documented sites on the McKenzie River RD.

Table 2. Biological Evaluation process for Willamette TES (or Proposed) fauna associated with potential effects from the Bridge Thin Project Action Alternative.

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 6
	Prefield Review	*Field Reconn.*	*Risk Assessment*	*Analysis of Significance*	*USFWS Review*
SPECIES	**Habitat Present (B,R,F,D)***	**Occupancy Status**	**Conflicts?** **Action Alt**	**Effects / Impacts** **Action Alt**	**Consul-tation? BA[1]/BO[2]**
Northern Spotted Owl ***Strix occidentalis caurina***	B,R,F,D	Occupied	Potential Conflict	NLAA	1/10/2008/ 02/07/2008
Northern Bald Eagle ***Haliaeetus leucocephalus***	B,R,F,D			NE	NA
Least Bittern ***Ixobrychus exilis***	No			NI	
Bufflehead ***Bucephala albeola***	No			NI	
Harlequin Duck ***Histrionicus histrionicus***	B,R,F,D			NI	
American Peregrine Falcon ***Falcon peregrinus anatum***	F,D	Occupied	No Conflict	NI	
Yellow Rail ***Coturnicops noveboracensis***	No			NI	
Black Swift ***Cypseloides niger***	No			NI	
Baird's Shrew ***Sorex bairdii permiliensis***	No			NI	
Pacific Shrew ***Sorex pacificus cascadensis***	No			NI	
Wolverine ***Gulo gulo***	F,D	Unknown	No Conflict	NI	
Fisher ***Martes pennanti***	No			NI	
Pacific Fringe-tailed Bat ***M. thysanodes vespertinu***	R,F	Unknown	No Conflict	NI	
OR Slender Salamander ***Batrachoseps wrighti***	B,R,F,D			NI	
Cascade Torrent Salamander ***Rhyacotriton cascadae***	No			NI	
Foothill Yellow-legged Frog ***Rana boylii***	No			NI	
Oregon Spotted Frog ***Rana pretiosa***	No			NI	
Northwestern Pond Turtle ***C. marmorata marmorata***	No			NI	
Mardon Skipper ***Polites mardon***	No			NI	
Crater Lake Tightcoil ***Pristiloma arcticum crateris***	B,R,F,D	Unknown	No Conflict	NI	

* B = breeding (nesting/denning) habitat R = roosting/cover habitat F = foraging habitat D = dispersal habitat

[1] Date of Biological Assessment (BA) Consultation initiated with USFWS

[2] Date Biological Opinion (BO) or Concurrence issued from USFWS

NA = not applicable

NE = **N**o **E**ffect

BE = **B**eneficial **E**ffect

NLAA[a] = May Affect, **N**ot **L**ikely to **A**dversely **A**ffect

LAA[b] = **May** Affect, **L**ikely to **A**dversely **A**ffect
NI = **N**o **I**mpact.
NLCT = May impact individuals or their habitat, but the action will **N**ot **L**ikely **C**ontribute to a **T**rend towards Federal Listing or loss of viability to the population or species.
MCT[c] = May impact individuals or their habitat, with a consequence that the action **M**ay **C**ontribute to a **T**rend towards Federal Listing or a loss of viability to the population or species.
BI = **B**eneficial **I**mpact

a A **NLAA** determination requires *informal consultation* with the U.S. Fish and Wildlife Service.
b For *listed* species, a **LAA** determination requires *formal consultation* with the U.S. Fish and Wildlife Service. For *proposed* species, a LAA determination requires *conferencing* with the U.S. Fish and Wildlife Service (WO Amendment 2600-91-3, Forest Service Manual 2671.45, March 31, 1991).
c A **MCT** determination may require that an Environmental Impact Statement be written.

AFFECTED WILDLIFE – Discussion/Determinations/Recommendations

A discussion of the affects of the proposed project on TES species follows. **If it was determined that suitable habitat for a species does not occur in the proposed project area** (Table 2), **it is concluded that the proposed action would have no potential to effect or impact those listed TES species**, and the species will not be discussed further in this document. **A No Action proposal is expected to have no effect on federally listed threatened, endangered, or proposed species, and is also expected to have no impact on sensitive species identified by the Regional Forester.** References used to support discussion, determinations, and recommendations are listed at the end of this document (Appendix 1).

1) Northern Spotted Owl (*Strix occidentalis caurina*)

Status: Federal: Threatened
State: Threatened
FS R-6: Sensitive, Identified as Management Indicator Species (MIS)

Determination: "may affect, not likely to adversely affect" northern spotted owls, "not likely to adversely affect" designated critical habitat. A full discussion of affects can be found in the Biological Assessment dated January 10, 2008 that was submitted to U S Fish and Wildlife Service.

Status Background: It has been reported that in some regards the northern spotted owl is the most studied raptor in the world (Blakesley 2004), yet prior to the early 1970's little was known about this species in the Pacific Northwest. Knowledge and interest quickly accumulated throughout the 1970's and in 1977 management guidelines for spotted owls on public land in Oregon were established. Driven by concerns over habitat loss, the USFWS conducted their first status review of the species in 1982. In 1987 a petition was submitted to list the spotted owl as endangered under the Federal ESA. The USFWS considered listing the species unwarranted at the time, however that decision was later reversed and the owl was officially listed as threatened under the Federal ESA in 1990.

Since that time a DRAFT Recovery Plan was released (USDI 1992), and the Northwest Forest Plan was implemented (1994) and subsequently amended (USDA et al. 2001, 2004) in efforts to most appropriately manage Federal land within the range of the northern spotted owl with the welfare of this and other late-successional species in mind.

Habitat and Ecology: The northern spotted owl is a species strongly associated with old-growth forests containing a component of large diameter Douglas-fir. These forest stands commonly provide a variety of structural features such as large diameter trees having central cavities, dense canopies with a high level of vertical and horizontal diversity, and an abundance of snags and down logs (Thomas et al. 1990). Stands with all these characteristics provide the best suitable (nesting, roosting, foraging) habitat for spotted owls. However, all of the above characteristics may not need be present for spotted owls to make use of an area as nesting, roosting or foraging habitat. The owl's affinity to old-growth forest types may result from adaptation and niche partitioning of this species to foraging on prey commonly present in such stands under lack of predation pressure and interspecies competition typical of more open areas (USDI 1992). Nevertheless, spotted owls have been known to forage short distances into harvested openings from a forested edge if a prey is available (Carey 2004).

Dispersal-only habitat for the northern spotted owl generally consists of mid seral stage stands between 40 and 80 years of age with canopy closures of 40 percent or greater and trees with a mean dbh of 11 inches or greater. Older stands lacking structural development that supports nesting may be considered dispersal habitat, however on some occassions may provide roosting or foraging opportunities for the species. Spotted owls generally use dispersal habitat to move between blocks of suitable habitat or, for juveniles, to disperse from natal territories (Forsman et al. 2002, USDI 2004a).

The reader is referred to the following documents for a more comprehensive and account of the biology, ecology, and status of the northern spotted owl: A Conservation Strategy for the Northern Spotted Owl (Thomas et al. 1990); Recovery Plan for the Northern Spotted Owl - (USDI 1992); Northern Spotted Owl Five-year Review Summary and Evaluation (USDI 2004a); Status and trends in demography of northern spotted owls, 1985 – 2003 (Anthony et al. 2004); Scientific evaluation of the status of the northern spotted owl - SEI Report (Courtney et al. 2004).

<u>Pre-field Review:</u> This project is consistent with current standards established for projects that could affect the northern spotted owl. These standards were established for the Willamette Province and are listed in both the Programmatic Biological Assessment (BA) (USDA et al. 2007) and the subsequent USFWS Letter of Concurrence (LOC) (USDI 2007) for projects which may disturb bald eagles and northern spotted owls during FY 2007 and 2008.

Effects not specifically discussed in this document pertaining to new threats to the spotted owl (USDI 2004a, Anthony et al. 2004, Courtney et al. 2004) such as wildfire, west Nile virus, and barred owls are of a cumulative nature considered beyond the scope of this individual project. Such threats are addressed in the FY 2006 – 2007 Disturbance BA and LOC, which provide a thorough analysis of new information pertaining to potential threats to this species.

<u>Field Reconnaissance:</u> There are seven northern spotted owl home ranges in the project area. No project units are within Late Successional Reserves. There are eleven units totaling 203 acres in designated Critical Habitat Unit OR-16. Post treatment stand conditions will maintain an average 40% canopy cover and functionality of dispersal habitat in the CHU.

No suitable breeding habitat is proposed for removal with the Bridge Thin project. Noise-generating activities from harvest and prescribed burning with this project that may disturb spotted owls during the critical breeding season (March 1 – July 15) will be restricted from occurring.

Risk Assessment:
Project Effects: There are no recognized direct or indirect effects to suitable spotted owl habitat from activities associated with this project as proposed. Effects to individual spotted owls that may be present in adjacent suitable habitat are limited to some potential for disturbance from noise-generating activities during the non-critical portion of the breeding season.

Cumulative Effects: The changing trend in timber management occurring within the past decade, and projected for the future, should positively influence occupancy of suitable habitat for northern spotted owls as previously harvested stands within these watersheds redevelop, and as more emphasis is placed on recruitment of key structural components missing from harvested stands as well as retention of key structural components present in unharvested stands and restoration/maintenance of special habitats as key components of biodiversity at a landscape level.

Current Standards and Guidelines governing management of the surrounding landscape provide direction that should provide for long-term maintenance of amount and distribution of suitable spotted owl habitat. Because of the location of harvest and non-harvest allocations, it is unlikely that cumulative effects would influence the ability of local populations to persist, or become established, by eliminating demographic linkages beyond the species dispersal capabilities.

Analysis of Significance: The Bridge Thin project does not propose any activity that would remove suitable spotted owl habitat. However this project does propose stand treatment activities that would remove dispersal habitat within all seven known spotted owl home ranges. It is determined that implementing the Action Alternative **may affect, but is not likely to adversely affect northern spotted owls or its designated critical habitat.**

Communication with U.S. Fish and Wildlife Service: Informal consultation for effects from proposed activities was submitted in a BA dated 1/10/2008. The USFWS issued their LOC for effects to spotted owls from this project on 02/07/2008 (FWS *reference*: 1-7-05-I-0025).

Recommendations: Impose seasonal restriction on project activities in close proximity to known location of spotted owls that could generate above-ambient noise levels during the spotted owl critical nesting period between March 1 and July 15.

2) Harlequin Duck (*Histrionicus histrionicus*)
Status Federal: Sensitive)
State: Sensitive

Determination: "no impact" to Harlequin Ducks or their habitat.

Status Background: The majority of documented harlequin duck use on the McKenzie River Ranger District occurs in the McKenzie River floodplain and its class 1 tributaries. Surveys have been conducted on the McKenzie River yearly since 1992. Nest are extremely difficult to find without the use of radio telemetry. No nests have been documented in the project area.

Habitat: During nesting (April-June) adults require fast-flowing water with midstream loafing sites nearby, dense shrub or timber/shrub mosaic vegetation on the bank, and an absence of human disturbance. Nests are typically found on the ground under the shelter of vegetation, rocks, or large woody debris in close proximity to water. Broods prefer low gradient streams with adequate macro invertebrate abundance.

Pre-field Habitat quality for harlequin ducks in this area is expected to continue to be high. There are no threats to water quality in the Mckenzie River or its tributaries. Human disturbance in riparian habitat (primarily in recreation sites) may cause the loss of nest sites. Disturbance from rafters on the River may cause disturbance to females with their young.
review:

Field reconnaissance: Breeding and foraging habitat are known to occur along portions of the Main stem and South fork of the McKenzie River.

Risk Assessment:
Project Effects: No suitable harlequin duck nesting habitat will be modified by this project. Due to the location and timing of proposed activities there should be no direct or indirect effects to harleuin ducks from disturbance that would influence breeding, foraging, or dispersal behavior.

Cumulative Effects:
Current Standards and Guidelines governing management of the landscape in watersheds surrounding the project area provide direction that should provide for long-term maintenance of amount and distribution of suitable habitat for *Harlequin ducks*. Riparian buffers will ensure protection to potential nest sites.

Analysis of Significance: The Bridge Thin Project does not propose any activity that would modify suitable harlequin duck nesting habitat, and activities that could result in disturbance to harlequin ducks by influencing either breeding or foraging behavior are not expected to occur due to spatial and temporal factors. It is therefore determined this projct should have **no impact on harlequin ducks and their habitat.**

Communication with U.S. Fish and Wildlife Service: Not required.

Recommendations: None warranted.

2) American Peregrine Falcon (*Falco peregrinus anatum*)
Status Federal: None (Delisted 8/99)
State: Endangered
FS R-6: Sensitive, Identified as Management Indicator Species (MIS)

Determination: "no impact" to peregrine falcons or their habitat.

Status Background: Following a global population depression and the near total disappearance of the American peregrine falcon (*Falco peregrinus anatum*) from habitat throughout much of the United States, largely as a result of environmental contamination (Cade et al. 1988, USFWS 2003), the peregrine was listed as endangered in 1970 under the Endangered Species Conservation Act of 1969 (precursor to the ESA) and subsequently listed under the ESA in 1973. After meeting a variety of objectives listed in regional recovery plans, the peregrine was removed from the ESA list of endangered species on August 25, 1999. Since that time monitoring results suggest that population growth has continued throughout the lower 48 states (USFWS 2003).

Habitat: In the Pacific states, preferred peregrine falcon nesting sites are sheer cliffs 150 ft. or more in height with horizontal ledges (USFWS 1982). On the Willamette National Forest, cliffs with potential for nesting by peregrine falcons include those that are at least 75 feet high, have horizontal ledges, ledges with overhangs or cave-like openings, have sheer faces inaccessible to ground predators and within .5 miles of riparian habitat (USDA 2000). Peregrine falcons feed almost exclusively on birds, many of which may be associated with riparian zones, large bodies of water or an abundance of snag habitat. Peregrine falcons feed on small birds that are present in drier, open areas, particularly where hardwood shrubs and trees are abundant. Some avian prey species select for closed coniferous forest. Peregrine falcons can forage widely for prey and will hunt over closed coniferous forest canopies as well as in open areas and over hardwood patches - wherever prey is abundant (Cade et al. 1988).

Pre-field review: There is no high quality suitable peregrine nesting habitat within or immediately adjacent to the project area. The Bridge Thin project area is within 4 miles of a known peregrine nest site, and is includes part of the tertiary management zone for that site (OE-82).

As a result of annual site monitoring, adult and young peregrines from the nearby nest site are known to forage for avian prey in and near the project area. Young peregrines may linger in the project area while dispersing from a nest site. Proposed habitat restoration activities would not modify or disturb any suitable peregrine nesting habitat. All proposed activities would occur late at a sufficient distance from nesting habitat such that any disturbance potential would be avoided (Pagel 1992,USDA2002).

Field reconnaissance: The peregrine nest site nearest to the project area has been monitored annually throughout the breeding season since its discovery in year 2000. The site has been occupied annually since that time, and has successfully fledged young during half of these years. Protocol surveys of potential peregrine nesting habitat near the Bridge Thin area have not been conducted for several years.

Formal breeding bird surveys have not been conducted within the planning area. The complete range of avian prey species that may currently occur in habitat throughout the project area is unknown, but expected to be typical for habitat associated with this area (O'Neil et al. 2001).

Risk Assessment:
Project Effects: No suitable peregrine nesting habitat will be modified by this project. Due to the location and timing of proposed activities there should be no direct or indirect effects to peregrines from disturbance that would influence breeding, foraging, or dispersal behavior.

Removal of trees and prescribed burning may modify or disturb habitat suitable for use by some potential peregrine prey species. Tree cutting and prescribed burning would typically occur outside the breeding seasons for most prey species that could be utilizing affected habitat. Modification or disturbance activities are considered relatively insignificant considering the overall amount of foraging habitat within management zones established for the known peregrine nest sites (approximately 26,000 acres). Any short-term (0-5 year) negative effects from proposed activities on potential peregrine prey species are considered offset by meadow and forest/meadow ecotone restoration, which increases habitat suitability for a variety of potential peregrine prey species.

Cumulative Effects: This project reflects an overall focus on habitat management that has occurred within the past decade, and projected for the future, that should positively influence occupancy of suitable nesting habitat and successful utilization of foraging habitat for peregrines as more emphasis is placed on recruitment of key structural components missing from harvested stands, retention of key structural components present in unharvested stands, and restoration and maintenance of special habitats as key components of biodiversity at a landscape level.

Analysis of Significance: The Bridge Thin Project does not propose any activity that would modify suitable peregrine falcon nesting habitat, and activities that could result in disturbance to peregrines by influencing either breeding or foraging behavior are not expected to occur due to spatial and temporal factors. It is therefore determined this projct should have **no impact on peregrine falcons and their habitat.**

Communication with U.S. Fish and Wildlife Service: Not required.

Recommendations: None warranted.

Wolverine (*Gulo gulo*)
Status: Federal: None
State: Threatened
FS R-6: Sensitive

Determination: "no impact" to wolverine or its habitat.

Status Background: The Bridge Thin Project is recognized historic and current range for the wolverine (*Gulo gulo (luscus)*) which was petitioned for federal listing under the Endangered Species Act (ESA) in July 2000. On October 21, 2003 the U.S. Fish and Wildlife Service (FWS) issued a 90-day Finding for a Petition To List as Endangered or Threatened Wolverine in the Contiguous United States. In that finding it was determined that the petition did "not provide substantial information indicating that listing may be warranted". An earlier (1994) petition to list the wolverine was found to be "not warranted" by FWS.

Taxonomy can lead to confusion when assessing the status of this species and its historic or current potential occurrence in these watersheds. Sighting records frequently include the name "California Wolverine". However, the validity of such a nominal subspecies has been questioned or is not recognized throughout much of the published literature devoted to addressing this species (Banci 1994, Johnson and O'Neil 2001, NatureServe 2005, Verts and Carraway 1998). Therefore further references to wolverine in this document are intended to be interpreted as *Gulo gulo*.

Records show that the wolverine has been listed on the Regional Forester's Sensitive Animal List for at least the past fifteen years. The wolverine was one of the original species classified as threatened by the Oregon Fish and Wildlife Commission in 1975. The status of the species was reviewed in 1988 (Marshall 1988) and as a result of that review wolverine are currently listed as threatened under the Oregon Endangered Species Act.

Habitat and Ecology: A large block of literature has been published in the past decade pertaining to the biology, ecology, and management of wolverine (Banci 1994, Claar et al. 1999, Copeland 1996, Heinemeyer et al. 2001, O'Neil et al. 2001, Verts and Carraway 1998). This is not meant to suggest that all aspects of the ecological relationships between this species and its environment are well understood. On the contrary, some relationships such as responses to human disturbance are just beginning to be understood based on a scientific rather than anecdotal context (Joslin and Youmans 1999; Rowland et al. 2003). The following is a gross summary of wolverine ecology considered pertinent to the presence of this species in the vicinity of the project area. The reader is strongly encouraged to reference the literature for a more thorough understanding of this species.

The wolverine has been referenced as the largest-bodied terrestrial mustleid (Banci 1994) with a body weight three to four times greater than the fisher despite having a similar overall body length. Its robust appearance allows adults to be described as resembling a small bear.

O'Neil et al. (2001) list the wolverine in Oregon as associated with 26 forest structural conditions, 11 habitat types, 17 habitat elements, and as serving 5 key ecological functions within the identified associations. Overall data do not support any statistical association between the species and a particular vegetative community – a fact reflected by O'Neil in attaching a low confidence to all associations listed for structural conditions and habitat types. Forested habitats used by wolverines appear to vary geographically and seasonally in areas where they have been studied (Claar et al. 1999). Habitat preferences have been linked to areas based on the availability of food and low human occurrence. The most specific habitat need of wolverines may be for female denning habitat secure from human disturbance (Copeland 1996) throughout the breeding season, which can range from November through April (Banci 1994).

Current definition and subsequent identification of suitable wolverine habitat has evolved largely from Copeland's (1996) study of a wolverine population in central Idaho. Because of a widely published concern regarding the sensitivity of wolverines to human disturbance at natal den sites (Banci 1994, Claar et al. 1999, Copeland 1996, Krebs and Lewis 1999, Lyon et al. 1994, Youmans 1999a), there seems to be scientific consensus that identification of female denning habitat is key to managing for this species where it is likely (or known) to occur. Following that logic the Willamette National Forest created a GIS layer in 1998 based on criteria provided by the Regional Office in an effort to identify potential denning habitat. Habitat generally described as areas having a northerly aspect for higher elevation cirque landscape features with a large boulder/talus component and a relatively open canopy was mapped across the Forest.

Wolverine are generally described as opportunistic omnivores in summer and primarily scavengers in winter while they utilize extremely large home ranges in proportion to their body size. Adult wolverine home range sizes average 148mi^2 for females and 610mi^2 for males (Copeland 1996). They are capable of foraging widely (30-40 km) on a daily basis, and do not significantly use young, dense stands of timber or clearcuts (Banci 1994). Virtually all studies that have investigated food habitats for the species have shown wolverine to be closely associated with a dependency upon the availability of large mammal carrion to balance its energy budget during critical periods of its lifecycle.

<u>Pre-field Review:</u> Habitat conditions during the reference era in watersheds surrounding the project area favored the likelihood of occupancy by wolverine as it is located well within the historic range for this species, and would have been relatively free from human disturbance – especially during the breeding season. Then, as now, population densities would be expected to have been low given our current understanding of wolverine ecology.

The USDA Forest Service Fiscal Year 1958 Annual Wildlife Statistical Report for the Willamette National Forest lists the wolverine as having occasional abundance and a stationary population trend. Suitable denning habitat existed within a wolverine's daily movement range at numerous locations surrounding the project area, and if wolverine were indeed present during that time the species would likely have occupied habitat in the area. Then, as now, the function of habitat associated with this project would have been to support year-round foraging and dispersal activities.

Maj and Garton (1994) mapped observation records for wolverine from 1961 through 1982, which show a cluster of sightings located within easy dispersal range of the project area. They also mapped records from 1983 through 1993, which show a sharp decline for sightings in the same location. Occurrence and breeding status data presented by O'Neil et al. (2001) show that wolverine both occurs and breeds in Oregon. A review of reported wolverine sightings on the Willamette National Forest conducted in May 2001 revealed 33 records of sightings between 1965 and 1999 on or adjacent to the Forest boundary, including sightings in watersheds where this project is located. There is no current verification this species occupies habitat in the area, and late-winter aerial surveys around denning habitat conducted from 1998 through 2001 have not detected the presence of wolverine within any adjacent watershed.

An issue regarding the reliability of current and historical presence of species such as the wolverine based on anecdotal records considered to be unverifiable has been raised (Aubry and Lewis 2003; McKelvey et al. 2002; McKelvey et al. 2000). The issue is associated with using such observational data combined with verifiable records to arrive at conservation actions and management recommendations. While some investigators believe combining such occurrence records results in scientific and legal vulnerability, others apparently do not (Rowland et al. 2003). Based on historic and current information, this analysis assumes the potential for wolverine to utilize habitat associated with this project for one or more of its biological requirements.

Field Reconnaissance: The Bridge Thin project is located adjacent prominent landscape features providing a westerly extension of upper elevation habitat connected to a vast remote area of the Western Oregon Cascades. Rocky outcrops associated with some potential habitat are visible from various locations within the project area. Most potential denning habitat is considered to be relatively free of human disturbance from winter recreation activities throughout much of the breeding season. However, winter activities such as cross country skiing and snowmobiling can be expected to occur periodically in surrounding areas. Although currently small in scale, these types of winter recreation do have potential to disturb wolverine – particularly a female that may be utilizing nearby denning habitat. This project or surrounding areas are open to a variety of human recreation activities throughout the remainder of the year. Activities such as hiking, horse back riding, and pleasure driving are considered to have less potential to disturb any wolverine that may be simply foraging or dispersing through nearby habitat.

The project area is recognized for its importance in providing habitat supporting local big game populations. Deer and elk are frequently observed during field visits to the project area. Improved forage habitat for big game would be created under this project's Action Alternative. Refer to this project's wildlife report for a further discussion of potential effects to big game habitat.

Habitat directly associated with the Bridge Thin Project is considered to be suitable as foraging and dispersal habitat for wolverine.

Risk Assessment:

Project Effects: This project proposes no activities that would result in modification or disturbance of potential natal denning habitat. Project activities that are proposed should not compromise foraging or dispersal opportunities for any individual to any estimable extent. For these reasons there are no recognized direct or indirect effects to this species associated with the project proposal.

Cumulative Effects: If security of natal denning habitat from human disturbance is critical for the persistence of wolverine in an area, the ability of this species to occupy otherwise suitable habitat in this area has likely been compromised by activities not associated with this project. Road building has allowed a variety of motorized and non-motorized winter recreation to extend into many areas surrounding the project area that were not historically readily accessible. Cumulative effects associated with human disturbance in the form of winter recreation have negatively influenced suitability of areas to support denning activity. Past, present, and ongoing winter activities in areas such as the East Fork McKenzie River , Castle Rock and MacDuff Mountain are examples of areas where suitability has been compromised.

If access to areas where wolverine may depend on larger mammals as a food source during critical times of the year is another factor influencing the persistence of this species in an area, wolverine have likely benefited from past harvest activity that has resulted in a wider distribution of forage habitat for big game. During the past decade however, harvest practices have changed and this positive contribution is waning rapidly as forage units regenerate into hiding cover. In addition, some former areas of natural forage habitat (such as the meadows associated with this proposal) are shrinking as forested stands expand in response to fire suppression.

The cumulative effect of this project on natural forage habitat as it pertains directly to big game and indirectly to wolverine will be positive, but immeasurable on a landscape scale.

Analysis of Significance: This project does not propose any activity that would modify or otherwise disturb potential wolverine denning habitat. Considering the wide-ranging nature of daily movements associated with wolverine foraging and/or dispersal behavior along with the low likelihood of occurrence and timing of restoration activities, this project should not result in disturbance to the species. It is therefore determined this project should have **no impact to wolverines or their habitat.**

Communication with U.S. Fish and Wildlife Service: Not required.

Recommendations: None warranted.

4) Pacific Fringe-tailed Bat (*Myotis thysanodes vespertinu*)
Status: Federal: None
State: None
FS R-6: Sensitive

Determination: "no impact" to individuals or habitat for Pacific Fringe-tailed bats

Habitat: The Pacific fringe-tailed bat was added to the Regional Forester's sensitive animal list in November 2000 based on the Natural Heritage Ranking for the species. This species is one of the three named sub-species of fringed myotis (*Myotis thysanodes*), which is among the bat species whose specific habitat needs are addressed under a Northwest Forest Plan standard and Guideline (2001 ROD pp 37-38).

This bat is considered a riparian associate species that has been associated with mixed-conifer forests having relatively dry moisture regimes in the Coast Range and southern Cascade Range of Oregon (NatureServe 2005, O'Neil et al. 2001). Other scattered locations occur in the Washington Cascades and into California and the desert Southwest. They may occur from near sea level to above 4000' in Oregon and utilize a wide range of habitats – from forested to non-forested (Hayes 2003, Verts and Carraway 1998). Foraging behavior specific to this species is poorly documented, however they have been described as aerial foragers and hovering gleaners (O'Neil et al. 2001). Maternity sites, hibernacula, and most documented individual roost sites for fringed myotis occur in rock crevices, caves, or anthropogenic structures. However Weller and Zabel (2001) recently published data that show a significant amount of individual roosting occurring in trees/snags when this species occurs in or near forested habitat. Structures associated with live trees or snags have since been recognized as the primary roost structures for this species when it occurs in/near forested habitat and features associated with caves, mines, bridges or buildings may serve as primary roost structures in non-forested habitat (Hayes 2003). Knowledge of roosting behavior is almost exclusively based on data obtained during the breeding season for this species which likely extends from May through August (O'Neil et al. 2001).

<u>Pre-field Review:</u> Despite an overall lack of survey data and poorly documented habitat requirements and life-history accounts for this species, its presence has been documented on the McKenzie River Ranger District (Ormsbee pers com., Verts and Carraway 1998). The potential exists that at least single individuals may utilize available forage and roost habitat throughout the summer and early fall in or adjacent to areas where proposed habitat restoration activities would occur.

<u>Field Reconnaissance:</u> Formal bat surveys within the project area have not been conducted. There are no caves, mines, or abandoned wooden bridges and buildings that would serve as suitable hibernacula nor are there known roost sites associated with other structures within 250 feet that would be affected by proposed activities. Some snags and decadent trees occurring adjacent to proposed treatment areas contain features suitable for roost use by bats – including *Myotis thysanodes*.

The current composition of habitat throughout the project area consisting of a mixture of forested and open (meadow) habitat creates a moderate amount of edge habitat, increasing the potential that individuals may use the area for foraging and either day or night roosting. Bats are known to use edge habitat more frequently than forest or open habitat, which is likely a function of avoiding dense clutter associated with forest habitat and areas where prey abundance may be reduced in open habitat (Hayes 2003).

<u>Risk Assessment:</u>
Measures can be taken to protect snags or decadent trees adjacent to the project area that may provide roosting habitat. Prescribed burning associated with portions of these meadows during late fall should not affect foraging opportunities for this species. Project activities should not compromise roosting or foraging opportunities for any individuals to any estimable extent, and therefore should not result in any direct effect to Pacific fringe-tailed bats. Indirect effects to this species may occur if larger trees are affected by prescribed burning such that they are modified and eventually develop into roosting habitat.

Cumulative Effects: Current Standards and Guidelines governing management of the landscape in watersheds surrounding the project area provide direction that should provide for long-term maintenance of amount and distribution of suitable habitat for *Myotis thysanodes*. Because of the range and location of land allocations in this area, it is unlikely that cumulative effects would influence the ability of local populations to persist, or become established, by eliminating demographic linkages beyond the species dispersal capabilities. The cumulative effect of this project on roosting or forage habitat as it pertains directly to this species would be immeasurable on a landscape scale.

Analysis of Significance: There is no known threat to hibernacula or maternity roosts from activities proposed under the Bridge Thin Project. Suitable roosting habitat adjacent to the project areas should not be affected by this proposal, and activities that could result in disturbance to this species by influencing either roosting or foraging behavior are not expected to occur. It is therefore determined this projct should have **no impact on Pacific fringe-tailed bats and their habitat.**

Communication with U.S. Fish and Wildlife Service: Not required.

Recommendations: Protect decadent trees and snags >12"dbh (roosting habitat) adjacent to the project area to the greatest extent feasible while conducting project activities.

5) Crater Lake Tightcoil (*Pristiloma arcticum crateris*)

Status: Federal: None
State: ODFW none / Natural Heritage S1
FS R-6: Sensitive / Survey and Manage Species

Determination: "no impact" to individuals or habitat for Crater Lake Tightcoil.

Status Background: The Crater Lake tightcoil had been listed as a Survey and Manage species since the 1994 Northwest Forest Plan ROD (USDA, USDI 1994). Under the 2001 ROD (USDA, USDI 2001) it was classified as a Category B species. The species was changed to a Category A species following the 2002 Annual Species Review where it remains considered rare, and for which pre-disturbance surveys are practical if habitat is present. It was added to the Regional Forester's sensitive animal list in July 2004.

The species is endemic to Oregon, and known to occur above 2000 feet elevation throughout the Oregon Cascades from the Mt Hood National Forest south to the Winema National Forest. As of August 2005 specimens had been confirmed at approximately 160 sites from very limited locations across this range (Duncan 2004, NatureServe 2005).

Habitat and Ecology: *Pristiloma arcticum crateris* "may be found in perennially moist situations in mature conifer forests and meadows among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 m. of open water in wetlands, springs, seeps and streams, generally in areas which remain under snow for long periods in the winter. Essential habitat componenst include uncompacted soil, litter, logs, and other woody debris in a perennially wet environment."(Duncan 2004).

This species is among many organisms functioning as primary and secondary consumers that contribute to soil building and dissemination of spores and microbes. Having very limited dispersal capabilities on their own, they may be assisted in dispersal by other vectors capable of transporting mud that may contain eggs or adults across distances into suitable habitat (Duncan et al. 2004). An example of such dispersal could be individuals in mud transported on the hoof of a deer or elk.

Loss or degradation of suitable wetland habitat has been identified as the major threat to this species.

Pre-field Review: Prior to 2005 the presence of the Crater Lake Tightcoil had not been documented on the Willamette National Forest. However in May 2005 a specimen that has since been confirmed to be *Pristiloma arcticum crateris* was collected on the Middle Fork Range District from a site in the North Fork of Middle Fork Willamette River Watershed to the southwest of this project area.

Based on habitat described in an established survey protocol for this species (Duncan et al. 2003) it is considered that suitable habitat for Crater Lake Tightcoil exists within portions of the project area.
Field Reconnaissance: Based on the three evaluation criteria to determine the need to conduct a survey, surveys for Crater Lake Tightcoil are not considered to be required for this project. This consideration is made because each of the three criteria necessary to trigger a survey would not be met for the following reason: perennially wet habitat associated with creeks in portions of the project area will be protected by a 10 meter buffer against all disturbance activities including prescribed burning. For this reason the persistence of the species if present in the project area should not be compromised.

Risk Assessment:
Project Effects: Because measures will be taken to protect suitable habitat for this species against disturbance or modification from effects associated with proposed activities, there are no recognized direct or indirect effects to this species or its habitat from the project.

Cumulative Effects: Because measures will be taken to protect suitable habitat for this species against disturbance or modification from effects associated with proposed activities, there are no recognized cumulative effects to this species or its habitat from the project.

Analysis of Significance: Suitable habitat for the Crater Lake Tightcoil exists in portions of the Bridge Thin Project area, however measures will be taken to protect this habitat where it occurs against disturbance or modification from effects associated with proposed activities, therefore there should be **no impact to Crater Lake Tightcoil or its habitat** from this proposal.

Communication with U.S. Fish and Wildlife Service: Not required.

Recommendations: Ensure that measures identified to prevent habitat disturbance within 10 meters of perennially wet areas are implemented during prescribed burning activities.

This document was prepared by: /s/ Shane D Kamrath Date: 1/18/08

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Appendix 1: Literature referenced during this biological evaluation to arrive at determinations regarding potential effects/impacts from proposed projects and activities.

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Bridge Thin Wildlife Specialist Report

File Code:	2600 Wildlife	Date:	11 January 2008
Route To:	Files		
Subject:	Terrestrial Wildlife Specialist's Report for: Bridge Thin Project		
To:	Files		

SUMMARY OF DETERMINATIONS

For reasons addressed later in this document **it is considered that activities proposed by the Bridge Thin Project should not result in any adverse impacts to other rare and uncommon species, MIS, or other terrestrial wildlife species, and long-term effects should be positive as a result of increased overall biodiversity. Taking No Action would have no effect on these species while allowing growth of timber stands to continue.**

Cumulative effects of this project in conjunction with other reasonably foreseeable projects in and adjacent to this area are not expected to influence the ability of other rare and uncommon species under the Northwest Forest Plan or as Management Indicator Species on the Willamette National Forest to persist or become established in habitat associated with the project area. Maintenance and/or recovery of late successional habitat serving as current or potential dispersal corridors surrounding the project area will ensure ongoing opportunities for occupancy and movement of terrestrial wildlife species that may occur in the vicinity of this project and are dependent on such habitat.

SUMMARY OF SEASONAL RESTRICTIONS/RECOMMENDATIONS

Implementing the following recommendations would ensure effects or impacts on listed species from proposed activities would be no greater than those addressed in this document, and also would mitigate those impacts.

- Ensure that measures identified in the proposal to avoid habitat disturbance within 10 meters of perennially wet areas are implemented. This measure would provide refugia in a limited amount of the project area for a variety of wildlife species that may be present and associate with habitat exposed to activities while being implemented.
- Protect decadent trees and snags >12"dbh when feasible while conducting project activities.

INTRODUCTION

This report serves to document potential impacts to terrestrial wildlife considered as other rare and uncommon species and Management Indicator Species (USDA 1990) plus other wildlife and associated habitat that may occur in or near a project area from activities associated with this project. A separate biological analysis/evaluation (BA/BE) addresses effects to threatened, endangered and sensitive (TES) fauna species.

PROJECT LOCATION AND DESCRIPTION

The McKenzie River Ranger Districts proposes to harvest timber on approximately 2256 acres of the Bridge Thin Project Area, which would yield an approximate net estimate of 35.6 million board feet (MMBF) of wood products. This proposal, represented in Alternative B in this EA, would include heavy thinning on 1458 acres, moderate thinning on 398 acres, oak savanna restoration on 51 acres, wildlife forage thinning on 190 acres and fuels treatment on 178 acres. The timber sales from this proposal would likely occur over a four year time span, beginning in fiscal year 2009.

The project is located on the McKenzie River Ranger District, Willamette National Forest, Lane County, Oregon. The legal location of the project is WM T15S R4,5 E, and T16S R4,5E. The Willamette

National Forest Land and Resource Management Plan shows land allocation in the project area as: 5a-special interest area, 7- Old growth Groves, 9c- Wildlife marten Area, 9d- Special Wildlife Habitat Area, 11a-Scenic Modification Middleground, 11c- Scenic Partial Retention Middleground, 11e-Scenic Retention Middleground, 11f- Scenic Retention Foreground, 14a-General Forest, 16a-Late Successional Reserve, and 17-Adaptive Management Area.

Forested habitat surrounding the project areas is most closely associated with the Westside Lowland Conifer Hardwood Habitat type described by Chappell et al. (2001).

Alternatives:
The Bridge Thin Project will be analyzed in an Environmental Assessment that reviews three alternatives – a No Action alternative and two Action Alternatives. The Action Alternatives involve activities described above.

Action Alternative: The influence of proposed activities on terrestrial wildlife is considered in the context of whether or not suitable habitat may be modified or if a species may be present at or near sites where physical disturbance may occur, or be sensitive to and thereby influenced by anthropogenic activities occurring during implementation of this project. Habitat disturbance that may affect some terrestrial wildlife species could occur as a result of this project. That potential is addressed later in this report.

No Action Alternative: There is no rationale to suggest the No Action alternative would affect or impact any terrestrial wildlife species based on their ecological requirements and current habitat conditions in the project area. Considering the No Action Alternative would have no effect/impact on terrestrial wildlife species is based on the following assumption - taking no action would not affect current habitat or wildlife species that may be present as either evolves without human management. The dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. Only potential effects or impacts of the Action Alternative will be discussed further in this document.

WATERSHED ANALYSIS / ADDITIONAL DOCUMENT SUPPORT

Proposed activities respond positively to recommendations made to address vegetation and wildlife in the Quartz Creek and Minor Tributaries Watershed Analysis.

MANAGEMENT DIRECTION COMPLIANCE

The alternative selected for management of the Willamette National Forest includes a strategy that provides Management Requirements (MRs) exceeding the minimum MRs established for Management Indicator Species (MIS) as presented in the Willamette Forest Plan FEIS Appendices - Volume 1 (USDA 1990, pp B-79 through 82). Maintenance of the MRs ensures the viability of MIS and the species they represent. The MRs have been further enhanced for most MIS species (i.e. those species dependent on old growth and mature conifer habitat, and dead and defective tree habitat) under the Forest Plan S&Gs as amended by the Northwest Forest Plan.

Proposed action associated with this project complies with current forest Standards and Guidelines (S&Gs) pertaining to MIS and other rare and uncommon species management. This proposal also complies with other S&Gs established in the Willamette National Forest Land and Resource Management Plan (1990) as amended by the Northwest Forest Plan Records of Decision (ROD) (1994, 2001, and 2004).

ADJACENT ACTIVITIES / CUMULATIVE EFFECTS

Many years of fire suppression have contained fires to a size of mostly less than one acre, resulting in light to moderate burn intensities. The fire suppression has also allowed conifer encroachment to occurring near the oak savannah habitat in this area.

GENERAL WILDLIFE OVERVIEW

As previously stated, forested habitat surrounding the project areas is most closely associated with the Westside Lowland Conifer Hardwood Habitat type described by Chappell et al. (2001). Within this habitat type, plant associations relevant to the project area vary considerably.

Westside Lowland Conifer Hardwood Habitat

Where it occurs in Washington and Oregon, 233 wildlife species have been identified as associated with the Westside Lowland Conifer Hardwood Habitat type described by Chappell et al. (2001).
These species includes birds, mammals, amphibians, and reptiles.

Historic sighting records and current inventory data have documented the presence of many species within or near the project area. Effects from project activities will enhance overall biodiversity in the area

Project Effects to General Wildlife: Proposed activities would generally occur outside the breeding season for most species and/or at a time when many may have migrated from the area or become seasonally inactive (Csuti et al. 1997, Marshall et al. 2003, O'Neil et al. 2001, NatureServe 2005). The timing of activities would mitigate potential short-term (< 5 years) negative effects from habitat modification such as temporary loss of some potential nesting habitat, or disturbance such as temporary displacement of individuals or their prey from thinning or prescribed burning activities. Habitat altering activities proposed by this project should not affect other terrestrial wildlife species such that their ability to persist in the vicinity of the project area or throughout their ranges would be compromised.

Project effects to associated species are essentially unquantifiable on an individual basis relative to the amount of habitat modified or disturbed against the amount available throughout the surrounding Westside Lowland Conifer Hardwood Habitat type and the affected plant associations within it. Project effects would result in a positive yet marginal overall contribution, with respect to restoring historic habitat and biodiversity, to cumulative effects that have occurred from past actions affecting the project area.

Recommendation Pertaining to General Wildlife: Ensure that measures identified in the proposal to avoid habitat disturbance within 10 meters of perennially wet areas are implemented. This measure would provide refugia in a limited amount of the project area for a variety of wildlife species that may be present and associate with habitat exposed to activities while being implemented.

SNAGS AND DOWN WOOD

The significance of the ecological role of snags and down wood in influencing ecosystem diversity and productivity is well addressed in the Willamette National Forest Land and Resource Management Plan (1990) and elsewhere (Brown et al. 2003). The significance of this relationship in coniferous forests of the Pacific Northwest is further emphasized by management S&Gs under the Northwest Forest Plan ROD (1994, 2001) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Laudenslayer et al. 2002, Lewis 1998, Muir et al. 2002, Rose et al. 2001).

Under the Willamette Forest Plan as amended by the ROD, snag habitat shall be managed at levels capable of providing for at least 40% or greater potential populations of cavity-nesting species. Current science has tested the validity of the potential population approach to species management, yet it remains the basis for S&Gs involving snag management. Strong support for identifying more appropriate amounts of snag and down wood habitat is being given to new approaches in addressing these habitat components. One such approach devoted to identifying appropriate levels of snag and down wood in selected habitat types is DecAID - the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon (Mellen et al. 2006). DecAID has been created to help managers decide how much dead wood to provide for this part of a species habitat needs, and is designed to apply to salvage as well as green tree projects. The benefit of DecAID applied to projects involving removal (harvest) of green trees is in evaluating affected habitat types during the planning process to determine if current dead wood levels are consistent with reference conditions, and to aid in identifying dead wood management goals for projects that affect dead wood habitat throughout dominant habitat types. Snag and dead wood habitat levels were compared to DecAID recommendations as well as Forest Plan S&Gs based on population potential.

Interpretation and/or application of advice obtained from DecAID pertaining to how the Bridge Thin Project may affect dead wood habitat is based on referencing information available in DecAID for the Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). The Bridge Thin Project is predominantly within this habitat type. All stands proposed for commercial thinning harvest are within this habitat type, and the Bridge Thin Project planning area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006).

Snags:

Estimates for current snag size and distribution are displayed in Table A, and were made based on estimates from a combination of stand exam data, knowledge of previous snag creation activity and field reconnaissance. Snag levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). Current snag levels throughout the planning area are above average values of the 50% tolerance range representative for snags in unharvested areas in this habitat type and condition.

Table A Current Condition (Alternative A- No Action) and Estimated levels of Snag Habitat for Alternatives B and C in Comparison with DecAID

Snag Size	Current Snag/Acre	DecAID- WLCH_OCA_S	
		Un-harvested inventory plots (unthinned managed stands)	All inventory plots (previously thinned and unthinned managed stands)
≥10" dbh	≈≥13 snags/acre	66th percentile	85th percentile
≥20" dbh	≈≥6 snags/acre	67th percentile	83rd percentile

The majority of large standing snags are Douglas-fir. The majority of smaller snags throughout the area is also Douglas-fir, and is a result of mortality from growth competition. Snag distribution across the project area can be considered patchy and variable, and would be affected equally under either Action Alternative.

<u>Down wood:</u>

Down wood estimates for current size and distribution were made based on reasoned estimates using inventory and stand exams from unthinned managed stands throughout the planning area. Tree mortality largely associated with self-thinning competition, cull logs from previous harvest activity, localized breakout from snow loading, and in one area wildfire has resulted in down wood levels as shown in Table B .

Smaller logs are generally in decay class I and II, while larger logs are in decay class II and III. Many of the largest pieces of down wood (cull logs from initial harvest activity) exist in decay class III. Plot data and field reconnaissance indicate existing down wood occurs in a patchy rather than even distribution across the planning area.

Table B Current Condition (Alternative A- No Action) and Estimated levels of Down Wood for Alternatives B an C in Comparison with DecAID

Down wood Size	Stand Type	Tons/Acre
≥6" diameter	Previously thinned managed stands	22.7 tons/ac
≥20" diameter	Previously thinned managed stands	18.4 tons/acre
≥6" diameter	unthinned managed stands	38.1 tons/acre
≥20" diameter	unthinned managed stands	24.8 tons/acre

In addition to dead wood levels associated with down logs, it is estimated that decaying wood habitat associated with stumps ≥20" diameter would cover less than 1% of areas treated under either Action Alternative. The amount is considered to be equal under either of these alternatives. Use of stumps throughout a range of decay classes has been documented for a wide variety of organisms (O'Neil et al. 2001, NatureServe 2006, Rose et al. 2001, Zabel and Anthony 2003). This type of dead wood provides a valuable, long-lasting habitat component that supplements the potential to maintain native biodiversity throughout the project area.

Down wood levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). A review of DecAID data discloses current down wood levels throughout the planning area are above average values (within the 50% tolerance range) representative for dead wood in both harvested and unharvested areas within this habitat type and condition. How down wood levels in the Bridge Thin Project planning area compare to DecAID data is displayed in Table C.

Table C – Current Conditions (Alternative A – No Action) and Estimated Levels of Down Wood for Alternative B and C and in Comparison with DecAID

Down Wood Size	DecAID- WLCH_OCA_S	
	Un-harvested inventory plots (unthinned managed stands)	All inventory plots (previously thinned and unthinned managed stands)
≥6” dbh	71st percentile	67th percentile
≥20” dbh	82nd percentile	78th percentile

Normal processes that influence these changes (dynamics) are highly variable in their ability to affect change (Rose et al. 2001). Natural fire interval for this area has been estimated at 50-200 years (USDA 1995). Insects and pathogens continually contribute to successional development, however traditionally this occurs at a small scale in this area relative to the overall landscape. The area is not prone to flooding or landslides which may also affect changes on a small scale. Windthrow is yet another normal process that has occurred, and will continue to occur unpredictably, to influence stand dynamics in this area on a small scale. Because the overall condition of the project area is largely influenced by previous management activities that have simplified stand and landscape structure and diversity, additional stand management may be seen as a method to assist in restoring some landscape conditions such as stand dynamics associated with creating more normal levels of snags and down wood. Snag creation in the 1990s through year 2006 have already contributed in this regard as an average of one snags/acre were created across approximately 12% of the project area.

A number of events throughout the watershed, as well as within the project area, have occurred to increase dead wood levels across the landscape. District fire records reveal that from 1970 to 2007, 46 small wildfires averaging less than one acre each have contributed to additional levels of dead wood in a patchy distribution throughout much of the WLCH habitat in four townships in the watershed immediately surrounding the project area. Any tree mortality associated with fires > 40 years ago is likely to currently function as down wood habitat. Mortality from fires within the past 40 years (n=46) is likely currently functioning as snag habitat. Fire intensity has ranged from mild to moderate under burning . No salvage has occurred associated with any of these events.

In addition to dead wood levels increasing related to effects from wildfire, effects from insects, disease, and other natural events have further increased this habitat component across the landscape surrounding the Bridge Thin Project area. Annual aerial insect and disease detection surveys from 1986 through 2006 have documented several sites across the watershed (including locations within the planning area) where snag habitat is increasing in a patchy distribution from effects of these mortality agents (USDA 2005).

Reference information extrapolated from DecAID suggests current size, abundance, and distribution of snags and down wood exceeds average historic levels (50% tolerance) across the project area considering habitat type and vegetation condition. It should be noted that with respect to snags or down wood, the objective of the Bridge Thin Project is more directed at managing for an average historic dead wood habitat condition rather than focusing on specific dead wood requirements for individual wildlife species.

Direct and Indirect Effects
Effects of Alternatives A, B and C – Snags and Down Wood

Some loss of existing snag habitat would occur under either Action Alternative, due to safety issues. Some existing snags in proximity to harvest activities would present a serious safety risk to workers involved with implementing the silvicultural prescription. Snag loss would be greatest among sizes <10" dbh, intermediate for snags ≥10" - <20" dbh, and lowest among snags ≥20" dbh. All felled snags would be left as down wood. Depending on decay class and burning conditions, some felled snags may be fully or partially consumed during subsequent fuels reduction and prescribed underburning in selected areas.

Under the silvicultural prescriptions for this project green trees would be harvested from specified areas by variable density thinning. Following these prescriptions would result in a minimum range of 34-72 trees per acre being retained, some of which may have defects that would provide a dead wood habitat component distributed throughout the project area. The silvicultural prescription for Riparian reserves calls for protection and retention of habitat features such as hardwoods and the largest conifers some of which possess decadent features providing an arboreal dead wood habitat component. The prescription would create 2 snags per acre to mitigate any snag loss.

Implementing the fuels treatment prescription under either Action Alternative should not affect current snag levels. On these acres, less than 10% live tree mortality estimated from under burning translates to approximately 3-7 snags/acre created in an area that involves approximately 40% of all acres thinned, and less than 1% of the planning area. However it is also reasonable to assume some level of partial or full mortality associated with trees immediately adjacent to pile burning activity. Any such mortality would add to an existing patchy distribution of snag habitat throughout the planning area.

Within stand variability throughout the planning area influences current snag distribution. This variability will also influence the location of replacement snags, which would be provided for in a patchy rather than even distribution across the area. This prescription is common to each Action Alternative and will assure compliance with Northwest Forest Plan guidance to maintain 40% of potential populations of cavity nesting species (USDA, USDI 1994 page C-42).

Post treatment snag sizes and quantities would also be consistent within the range of average levels recently provided from plot data from unharvested stands in a Western hemlock vegetation series such as those influencing habitat throughout the project area (McCain 2006). These data are presented in terms of tolerance levels and tolerance intervals described in DecAID. They reveal that 50% of individuals in all populations of species using snags in a Douglas Fir and Western hemlock series types can be expected to occur where a range of 4-7 snags per acre ≥ 20" dbh exist. Although these data apply to unharvested tree condition class stands, snag habitat throughout the Bridge Thin project area would fall within this range.

Based on current stand structure, composition, and habitat type there is generally sufficient site-specific potential to support application of the Northwest Forest Plan Standard and Guideline (ROD page C-40) to leave an average of 240 linear feet of logs per acre greater than or equal to 20 inches in diameter or material of the largest diameter class available across areas treated by the Bridge Thin Project under either Action Alternative.

Cumulative Effects: **- Snags and Down Wood**

The cumulative effects analysis area was the Bridge Thin project area. As mentioned above the project area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006)

Past management actions related to timber harvest activity are generally responsible for the current condition of dead wood habitat throughout the planning area. These actions have affected the overall amount and distribution of dead wood habitat by reducing the amount of old-growth habitat and increasing the amount of mid-late seral habitat. There are no foreseeable actions that would affect dead wood habitat in this area. Current science and the changing trend in timber management that has occurred within the past decade, and projected for the future, should positively influence management of decaying wood as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands.

Data analysis reveals the amount and distribution of snag and down wood habitat would essentially remain unchanged or experience a slight increase under either Action Alternative. Commercial thinning as proposed under either Action Alternative for the Bridge Thin Project is therefore likely to have little or no cumulative effect on dead wood habitat throughout the planning area. The action alternatives would provide other ecological benefits by allowing trees to grow larger and faster, and to develop other desirable tree habitat characteristics such as large limbs and crowns.

Dead wood habitat should exist in a sufficient amount and distribution to support the local wildlife community, including MIS such as pileated woodpecker, marten, and cavity nesters such that their ability to persist or become established would not be limited by this habitat component important to most members of the wildlife community in this area.

Conclusion – Snags and Down Wood

Under either Action Alternative the Bridge Thin Project proposes commercial thinning in approximately 55% of mid-seral (stem exclusion) habitat throughout the planning area. This relates to approximately 18% of the entire planning area. Proposed openings associated with compaction areas under Alternative B are generally lacking in snags and down wood. There is essentially no difference between Action Alternatives and their effect on dead wood.

The silvicultural prescription calls for protection of existing snags and down logs. However some amount of loss or disturbance of snags and down wood is inevitable as a result of safety and logging feasibility issues. Measures are identified to address this loss or disturbance. Effects analysis reveals that proposed activities in conjunction with mitigation measures would result in a stable or slight increase in dead wood levels associated with areas treated. Direct and indirect effects would be limited to an undeterminable number of snags and logs that may be unavoidably affected or created within harvest units.

DecAID relies on data from unharvested plots to assist managers in setting objectives aimed at mimicking natural conditions. Considering the current condition of snag and down wood habitat along with the information presented above, it is expected that dead wood levels throughout the planning area should remain above average in the natural range considered for similar habitat following thinning, prescribed fuels reduction, and underburning.

The Bridge Thin Project would result in maintenance and promotion of dead wood habitat throughout a managed forest that typifies the planning area at levels that would ensure its ongoing central role in the ecological processes affecting this type of forested habitat (Rose et al. 2001). The project would comply with S&Gs pertaining to snag and down wood management.

Project Effects to Snags and Down Wood:
Data analysis reveals the amount and distribution of snag and down wood habitat would essentially remain unchanged or experience a slight increase under either Action Alternative. Commercial thinning as proposed under either Action Alternative for the Bridge Thin Project is therefore likely to have little or no cumulative effect on dead wood habitat throughout the planning area. The action alternatives would provide other ecological benefits by allowing trees to grow larger and faster, and to develop other desirable tree habitat characteristics such as large limbs and crowns.

Recommendations pertaining to snags and down wood:
Protect decadent trees and snags >12"dbh adjacent to the project area to the greatest extent feasible while conducting restoration activities.

OTHER RARE OR UNCOMMON WILDLIFE SPECIES

Species listed below in Table 2 were compiled from the 2001 and 2003 Annual Species Reviews and incorporate those vertebrate species whose known or suspected range includes the Willamette National Forest according to the following documents: Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004 and Survey Protocol for the Red Tree Vole v2.1, October2002.

Table 2: Other Rare or Uncommon Wildlife Species Known on the Willamette National Forest.

Species	Survey Triggers			Survey Results			Site Management
	Within Range of the Species?	Project Contains Suitable habitat?	Project may negatively affect species/habitat?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	
Vertebrates							
Great Gray Owl (*Strix nebulosa*)	Yes	No	No	No	NA[1]	NA	NA
Red Tree Vole (*Arborimus longicaudus*)	Yes[2]	Yes	Yes	Yes	7/2007	Yes	Yes

[1] N/A = Not Applicable

Red tree vole (*Arborimus longicaudus*):
This project is within the Northern Mesic Zone where the red tree vole is uncommon, and pre-disturbance surveys are considered practical. Surveys for red tree voles were conducted in suitable habitat and located one site in unit 82, with a 10 acre buffer being established to protect the site.

Other ROD Species/Habitat:

Cavity-nesting birds - White-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl: The white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl will not be sufficiently aided by applying mitigation measures for riparian habitat protection or other elements of the Northwest Forest Plan (USDA, USDI 2001 and 2004). These four species occur primarily on the periphery of the range of the northern spotted owl on the east slope of the Cascade Range in Washington and Oregon however, they are not likely to occur in the project area.

To ensure the distribution and numbers of all four species do not decline on BLM Districts and National Forests within the range of the northern spotted owl, adequate numbers of large snags and green-tree replacements for future snags in appropriate forest types within the range of these four species will be maintained in sufficient numbers to maintain 100 percent of potential population levels of these four species (USDA, USDI 2001 and 2004).

A discussion of how proposed activities may impact this habitat component is conducted in the Snags and Down Wood section of this document.

The influence of this project on these species is considered either neutral or beneficial. Proposed activities would generally occur outside the breeding season, and the likelihood that they occur in the project area is considered low. Beneficial influences are associated with a potential to improve foraging habitat and overall biodiversity that may attract their presence in the area.

Bat roosts – caves, mines, and abandoned wooden bridges and buildings: There are no caves, mines, abandoned wooden bridges or buildings within the project area that would need to be protected from activities associated with this project.

<u>Project Effects and Cumulative Effects to Other Rare or Uncommon Species, and Other ROD Species</u>: Activities proposed by this project include measures that maintain and protect habitat components important to support potential use by other rare or uncommon species, and other ROD Species. Implementing project activities as proposed should have no direct or indirect effect on these species such that their ability to persist within the project area or throughout their ranges

Current S&Gs governing management of this area provide direction that should ensure the long-term maintenance of amount and distribution of suitable habitat for this group of species. With respect to restoring historic habitat and biodiversity that may benefit these species, project effects may result in a positive yet marginal overall contribution to cumulative effects that have occurred from past actions within the project area.

Ensure that perennially wet habitat associated with springs in portions of Bridge Thin area are protected by a 10-meter buffer against disturbance from proposed activities including prescribed burning.

Recognize previous recommendations made in this report pertaining to snags and other dead wood habitat.

<u>MANAGEMENT INDICATOR SPECIES (USDA 1990)</u>

<u>Background and Effects Summary</u>: The Willamette Forest Plan has identified a number of terrestrial wildlife species with habitat needs that are representative of other wildlife species with similar habitat requirements for survival and reproduction. These management indicator species (MIS) include spotted owl, bald eagle, peregrine falcon, cavity excavators, pileated woodpecker, deer, elk, and marten. Spotted owls, bald eagles, and peregrine falcons are addressed in a separate Biological Assessment and Biological Evaluation. The other MIS have potential to occur in or near the project area and are

addressed below. Activity associated with the proposed action is consistent with, or exceeds Willamette Forest Plan Standards and Guidelines as they pertain to MIS management.

Habitat for terrestrial MIS modified by activities associated with the proposed Bridge Thin Project would be limited to foraging use by these species. Activities could result in disturbance to MIS that may be present in or adjacent to proposed treatment sites. However, any modification or disturbance that may occur associated with this project is not of a scale that would threaten the viability of any MIS to persist within the project area or throughout the range of these species.

<u>Pileated Woodpecker:</u>
Current, as well as historic, composition and structure associated with habitat type and plant associations surrounding the project area favor nesting and foraging use by pileated woodpeckers (Csuti et al. 1997, Marshall et al. 2003, NatureServe 2005, O'Neil et al. 2001).

Effects from proposed activities previously addressed in this report pertaining to snags and down wood as habitat important to cavity nesting birds, are also relevant to how this restoration project may affect this MIS.

Currently the Oregon Natural Heritage Program (ONHP), The Nature Conservancy (TNC), and the Oregon Department of Fish and Wildlife (ODFW) show the status of the pileated woodpecker to be secure, which suggests the changing trend in timber management that has occurred within the past decade, and projected for the future, may positively influence occupancy of suitable habitat by this species as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands (USDA 1985, USDA 1994).

<u>Marten</u>:
Marten occupy a narrow range of habitat types found in or near coniferous forests. More specifically, they associate closely with late-successional stands of mesic conifers – especially those with complex physical structures near the ground such as large low snags and down wood (Chapin et al. 1997, NatureServe 2005, Ruggiero et al. 1994, Verts and Carraway 1998, Zielinski et al. 2001). Current habitat surrounding the planning possesses such characteristics. Marten are known to occur within the project watersheds, and despite lack of documented presence in the immediate vicinity it should be assumed the species is likely a member of the local faunal community.

In the General Wildlife Overview section of this report the marten was identified as a species closely associated with habitat in and adjacent to this project area. Effects identified pertinent to general wildlife, as well as to snags and down wood, apply to this MIS. Because marten prefer a more interior setting, large snags or down logs that could function as denning habitat would not be affected by this project. Foraging habitat for marten would likely improve as a result of beneficial habitat changes for prey species known to be favored by marten such as voles, rabbits, squirrels, and mountain beaver (Csuti et al. 1997).

Currently the ONHP, TNC, and the ODFW show the status of this species to be secure or not immediately imperiled, which suggests species viability may be assured as long as adequate protection measures such as Standards and Guidelines governing activities proposed by this type of project continue to be implemented. The changing trend in timber management that has occurred within the past decade, and projected for the future, may positively influence occupancy of suitable habitat for marten as previously harvested stands redevelop, and more emphasis is placed on recruitment of key structural components missing from harvested stands and retention of key structural components present in unharvested stands.

Cavity Excavators:

The significance of snags as one component characterizing both old-growth and younger timber stands, and the dependence of primary cavity excavators on this component as MIS that provide nesting and denning habitat for numerous additional species of birds and mammals (secondary cavity nesters) is thoroughly addressed in the Willamette National Forest Land and Resource Management Plan (1990). The significance of this relationship is further emphasized by management S&Gs under the Northwest Forest Plan ROD (1994, 2001, 2004) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Lewis 1998, Muir et al. 2002, Olson et al. 2001, Rose et al. 2001).

All species of primary cavity excavators used as ecological indicators in the Willamette Forest Plan (USDA 1990) have current and/or future potential to occupy habitat surrounding the project area based on recognized associations with the Westside Lowland Conifer Hardwood Forest Habitat type (O'Neil et al. 2001).

Effects from proposed activities previously addressed in this report pertaining to snags as habitat important to cavity nesting birds, are also relevant to how this project may affect this group of MIS cavity excavators. This project does propose modification of current nesting habitat and could result in disturbance during the breeding season for this group of species. The number of small snags identified as a safety hazard to work areas that may be felled or that could be affected by thinning and prescribed burning is considered inconsequential relative to this type of habitat component in the surrounding landscape where fire is recognized as the major natural disturbance (Chappell et al. 2001).

Activities proposed by this project include measures that maintain and protect habitat components important to support use by the group of cavity excavators listed as MIS. Implementing project activities as proposed should have no direct or indirect effect on these species such that their ability to persist within the project area or throughout their range. Current Standards and Guidelines governing management of this area provide direction that promotes long-term maintenance of amount and distribution of suitable habitat for this group of species. With respect to restoring historic habitat and biodiversity that may benefit these species or their prey, project effects should result in a positive yet marginal overall contribution to cumulative effects that have occurred from past actions affecting the project area.

Elk/Deer (Big Game):

Current Condition – Big Game Habitat

The Bridge Thin planning area has three designated Elk Emphasis Areas: Florence, Taylor, and Minor Tributaries (See Elk Emphasis Area Map in Appendix D). The areas are designated as High, Moderate and Low Emphasis Areas respectively. These areas are managed for elk habitat under guidance from the Willamette Forest Plan Standards and guidelines (FW-137) with the assumption that providing high quality elk habitat would adequately address the needs for black-tailed deer.

A Model to Evaluate Elk Habitat in Western Oregon (Wisdom, 1986) is used to estimate habitat effectiveness (HE), which is defined as the proportion of achievement relative to an optimum condition. The management intent is to maintain effectiveness within a range of values with the optimum value being 1.0. HE incorporates and qualifies four key habitat attributes; size and spacing of forage (HEs), quality of forage (HEf), cover areas (HEc), and open road density through elk habitat (HEr). Each habitat variable is calculated individually and allows for a comparison by variable or as a whole (HEI). The elk model considers past and ongoing activities.

Table C displays the current condition of habitat values for patch size and spacing (HEs), open road density (HEr), cover quality (HEc), forage quality (HEf), and overall habitat quality (HEI) that existed for big game habitat when watershed analyses were conducted for these areas.

Table C HEI Analysis for Big Game Habitat in the Bridge Thin Project Area

BGEA Name	BGEA Emphasis Level	Results for Each Model Variable Indices				
		HEs	HEr	HEc	HEf	Overall HEI
Florence	High	0.71	0.41*	0.50	0.33*	0.47*
Taylor	Moderate	0.37*	0.57	0.33*	0.45	0.42
Minor Tribs	Low	0.49	0.56	0.73	0.53	0.56

* Values are below recommended minimum threshold levels
Willamette NF Land Management Plan S&G Target Level:
High Level BGEA Individual Index: >0.5 Overall index: >0.6
Moderate Level GBEA Individual Index: >0.4 Overall Index: >0.5
Low Level GBEA Individual Index: >0.2 Overall index: increase any variable <0.2

Summary of Existing Elk Model Variables for the BridgeTthin Project Analysis Area:

Size and Spacing of Forage: The size and spacing habitat effectiveness rating (HEs) for forage and cover in two elk emphasis areas indicates that the existing distribution of cover and forage is very good and that management goals for size and spacing are currently being met for Florence (0.71) and Minor Tribs (0.49). The size and spacing for Taylor (0.37) is currently below Forest Plan recommendations.

Road Density: Road densities in two areas are currently adequate with HEr values of Taylor (0.57) and Minor Tribs (0.56). Road densities in the Florence (0.41) area is currently below Forest standards.

Cover: The habitat effectiveness value for cover (HEc) in the Florence (0.50) area and the Minor tribs (0.73) area are currently meeting the Forest Plan standards. The Taylor (0.33) emphasis area is currently below Forest Plan standards.

Forage: The forage quality habitat effectiveness rating (HEf) for Taylor (0.45) and minor Tribs (0.53) are currently meeting Forest Plan standards. The Florence (0.33) area is currently below Forest Plan standards for forage quantity and quality.

Habitat Effectiveness Index (HEI): The overall ratings of (HEI) indicate that two emphasis areas are currently above Forest plan standards: Taylor (0.42) and Minor Tribs (0.56). The overall HEI rating for Florence (0.47) is currently below Forest Plan standards.

Forage, Hiding, Thermal and Optimal Thermal Habitat, and Road Densities

Past harvest activities have shaped the landscape in terms of the juxtaposition and types of elk habitat. Since the 1940s, over 2800 acres have been managed with timber harvesting. Harvest treatments were primarily regeneration, including clearcuts and shelterwoods. These harvested units once provided a wealth of quality forage for elk but have since grown into hiding and thermal cover. No specific data are available for the local elk/deer population within the three BGEAs for this project. Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Recent ODFW elk population estimates show that state management unit in the vicinity of the project area (McKenzie) have elk herds with population numbers near their current management objectives (Bill Castillo pers com; ODFW 2005).

Maintaining a balance between cover and forage areas is a key component of elk habitat management in the Wisdom model. Using tightly controlled experimental conditions, Cook et al (1998) found that thermal cover did not enhance elk survival and production, was not required by elk where food was not limiting, and could not compensate for inadequate forage conditions. Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, and population growthand stability (Cook et al. 2004). The increased importance of available forage abundance and quality compared to thermal cover has also been supported by nutritional and physiological studies of black-tailed deer (Parker et al. 1999).

The Wisdom model was developed to evaluate landscape areas where quality forage areas were provided primarily by clear cutting and associated post-harvest burning and fertilization. With the dramatic decline in regeneration timber harvest under the Northwest Forest Plan, there has been a corresponding decline in high-quality elk forage habitat. This trend, coupled with recent studies, has increased the importance of providing foraging habitat for elk on the Forest. A drawback of the Wisdom model is that forage is evaluated based on the average value of defined forage areas and does not consider the amount of forage provided. Areas that do not provide meaningful forage are not considered in the forage effectiveness calculations. Consequently, providing substantial acres of temporarily improved elk and deer forage conditions by commercial thinning may result in a lower forage score in the Wisdom model if these acres lower the average value for forage areas in the landscape. Published research support the idea that increasing the amount of available forage by commercial thinning should improve the overall habitat conditions for elk and deer within the analysis area regardless of the average forage value derived from the Wisdom model.

Direct and Indirect Effects

Effects of Alternative A – No Action

Current trends of elk habitat development would continue to occur naturally over time with Alternative A. Existing elk foraging habitat is expected to continue growing into hiding cover and then to thermal cover. Thermal cover would continue to grow toward optimal thermal cover. There would be no change to the current elk effectiveness ratings.

In ten years, forage availability would be expected to decrease in this area as current openings succeed into hiding cover. In the absence of additional harvest or wildfire, no new foraging areas would be created. The current optimal and thermal cover would not significantly change.

In 50 years, approximately 30% of the existing thermal cover would shift into optimal thermal cover. Hiding cover would succeed into thermal cover. Road density and big game security would not change. Overall habitat quality may decrease from the loss of forage.

Effects of Alternatives B and C

The proposed thinning (approx 2256 acres) and prescribed burning (approx 1000 acres) for the Bridge Thin project would change the function of big game habitat from thermal cover to: either lower quality thermal cover, or hiding cover or foraging. Alternatives B and C propose 227 acres of wildlife thinning, intended to improve big game forage in the heart of the high emphasis Florence area where forage quality are currently lacking. In addition unit 80 (10 acres) in Alternative B only would propose a forage area intended for repeated underburning and manual forage enhancement to maintain a beneficial forage production area. The proposed oak savanna treatments would restore approximately 56 acres of historic open oak savanna habitat with a dominated grassy forage understory. The remaining acres for the Bridge Thin project would provide a limited short-term (<5-6 years) benefit to forage from light to moderate thinning until the tree canopies close in as a result of tree crowns responding to reduced competition for sunlight. Road densities would not measurably change with the Elk Model with 0.2 miles of additional roads being closed with this project.

Cumulative Effects

Analysis for cumulative effects is based on an area comprised of the three BGEAs Emphasis Areas where management activities would occur. The BGEAs Emphasis Areas were used for the scope of analysis because of the determined ratings for elk habitat that is described for the BGEAs Emphasis Areas in the Willamette National Forest.

Past management activities initially resulted in an abundance of forage habitat with the many acres of regeneration harvesting that occurred. The more recent lack of harvest has allowed these forests to grow into hiding and thermal cover to create the current condition represented by the no action alternative in the Table 3. The overall impact of the proposed action is that thermal cover in the treated stands would be changed to lower quality thermal cover, or hiding cover or forage. There are no foreseeable actions that would modify habitat in these BGEAs.

Conclusion – Big Game Habitat

Proposed activities would increase habitat quality for elk and deer in all three BGEA emphasis areas. Open road densities would not measurably change. Forage quality would definitely increase on 233 acres in Alternative B and 223 acres in Alternative C. Beneficial effects to big game forage from thinning and prescribed burning proposed by this project are not significant in scale and are not expected to be reflected in individual or overall habitat effectiveness values in the elk model given the majority of acres in a thermal cover classification. A limited number of animals would benefit from the small-size openings that would be created by the project, so there would be little potential for any noticeable population response as a result of the proposed actions. Project effects to big game are essentially unquantifiable on an individual basis relative to the amount of habitat modified or disturbed against the amount available to these species on a daily basis in the affected BGEAs. Direct and indirect effects are largely limited to potential temporary displacement of individuals occurring in habitat during implementation of proposed activities. Short and long-term effects to forage habitat will be beneficially evident within the project area. In the context of the BGEAs, and adjacent 5th field watersheds, project effects would result in a minor positive contribution to cumulative effects that have already occurred from past management actions surrounding the project area. Given what is currently known about local deer and elk populations, the future viability of these species should be assured as long as habitat restoration opportunities continue to be implemented – especially when conducted at an appropriate scale.

MIS summary:
Although proposed activities would modify some suitable habitat, and likely disturb some individual terrestrial MIS that may be present, they should not threaten the capability of any local population of these species to persist or become established in the project area. Any project effect considered negative in this regard would be short-term and minimal compared to the amount of habitat available in the surrounding landscape. Cumulative effects to MIS from proposed activities would be small in scale yet generally beneficial, as they contribute to long-term improvements in the overall diversity of habitat in the Bridge Thin area.

Current available data or reports on the status of the above MIS, and additional information on the status and management of these MIS may be found on the following websites:
http://oregonstate.edu/ornhic/ORNHP.html
http://www.heritage.tnc.org/nhp/us/or/
http://www.dfw.state.or.us/ODFWhtml/InfoCntrWild/InfoCntrWild.html

Recommendations Pertaining To MIS: For cavity excavators (including pileated woodpecker and secondary cavity nesters) and marten - recognize previous recommendations made in this report pertaining to snags and other dead wood habitat.

For Elk/Deer: Consider additional activities that improve forage habitat throughout summer and winter range within Florence, Taylor, Cougar and Minor Tributaries BGEAs.

MIGRATORY LAND BIRDS

Land bird species exhibit a dramatic response to the height, seral stage, canopy structure, and spatial distribution associated with forest habitat where greater numbers of birds are associated with more complex heterogeneous forested landscapes (Altman 1999). The current amount of forested and open ecotonal habitat characteristic throughout the project area should be attractive for use by a variety of avian species (Gilbert and Allwine 1991). However effects from past management practices – specifically fire suppression – have resulted in simplification of habitat throughout this area as forest encroachment progresses on meadow habitat.

Effects to Migratory Land Birds: Proposed activities would generally occur outside the breeding season for these species and/or at a time when many may have migrated from the area (Csuti et al. 1997, Marshall et al. 2003, O'Neil et al. 2001, NatureServe 2005). The timing of activities would mitigate potential short-term (< 5 years) negative effects from habitat modification such as temporary loss of some potential nesting habitat, or disturbance such as temporary displacement of individuals or their prey from thinning and prescribed burning activities. The number of individuals and/or species potentially affected by proposed activities is unknown and considered unquantifiable without reliable survey data. Habitat changes proposed by this project should not affect this group of species such that their ability to persist in the vicinity of the project area or throughout their ranges would be compromised.

Altman and Hagar (2007) identify 93 bird species in the Pacific Northwest that regularly breed in conifer forests less than 60 years of age. Over half of these species are experiencing population declines. Thinning generally does not change habitat conditions so dramatically that bird species can do longer use the stand, but often temporarily increase or decrease bird abundance depending on species. Altman and Hagar (2007) summarize studies showing 21 species of migratory birds whose range overlaps the project area increasing in abundance following forest thinning treatments. Seventeen migratory bird species did not changed in abundance or had mixed responses in forests that were thinned, while 7 species generally decreased in abundance, at least temporarily, after thinning. Silvicultural treatments that promote understory shrub development, trees species diversity, deciduous trees, and the growth of larger trees; maintain or create snags and downed logs; and create gaps in the stand generally improve avian biodiversity in the stand. Thinning has not been shown to have long term negative effects on any sensitive bird species or species of special concern.

Given these considerations, both short and long-term suitability of open forest, meadow, and edge habitat in and near proposed treatment areas should improve for the majority of bird species that are likely to forage and nest in this area – albeit on a small scale compared to the surrounding landscape.

Project effects to Migratory Land Birds are of no measurable consequence on an individual basis relative to the amount of habitat modified or disturbed against the amount available throughout the surrounding Westside Lowland Conifer Hardwood Habitat type and the affected plant associations within it. Project effects would result in a positive yet marginal overall contribution, with respect to restoring historic habitat and biodiversity, to cumulative effects that have occurred from past actions affecting the project area.

Recommendations pertaining to Migratory Land Birds: Consider enlisting the expertise of a group such as the local chapter of the National Audubon Society in initiating an annual breeding bird survey route in habitat associated with this project's restoration activities in order to gain a better understanding species occurrence and habitat use in this area.

This document was prepared by: /s/ Shane D. Kamrath Date: 1/11/2008

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Appendix 1: Literature referenced during preparation of this report to arrive at determinations regarding potential influence of the proposal on terrestrial wildlife species and habitat.

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COVER INFORMATION

Reply To: 2550 Soil Management
2520 Watershed Protection and Management

Subject: SOIL AND GEOLOGY REPORT
Bridge Environmental Assessment

To: District Ranger, McKenzie River Ranger District

By: Douglas C. Shank, Forest Geologist

Date: November 3, 2007

I. INTRODUCTION

A. PURPOSE AND NEED FOR PROJECT

The District Ranger of the McKenzie River Ranger District of the Willamette National Forest has determined that a need exists to commercially thin about 2800 acres of managed and fire regenerated stands in the McKenzie River / Quartz Creek Watershed. The purpose of the project is to:

1) Improve the growth of various plantation timber stands and promote forest health by reducing current stocking levels to enhance growth and vigor of the remaining trees and to reduce future losses from fire, insects, disease, and from snow breakage; 2) Restore structural diversity in stem exclusion stands to enhance wildlife habitat; 3) Maintain or reduce the existing road system as much as is practical; and 4) Provide a sustainable supply of commercial wood products.

In summary, the purpose of this project is to improve timber stand health and vigor, enhance tree growth, maintain roads, and provide wood products from previously managed stands. An additional aim of the project is to enhance conditions in riparian areas to meet Aquatic Conservation Strategy Objectives. By enhancing tree growth, larger trees will better provide more shade for streams, moderate microclimate, improve overall structural diversity, and contribute future sources of coarse woody debris for streams.

B. PROPOSED ACTION AND CONNECTED ACTIONS

The District Ranger for the McKenzie River Ranger District of the Willamette National Forest proposes to implement the following actions during the next five years within previously managed or naturally fire regenerated stands in various management allocations in the lower McKenzie watershed. The Bridge project includes the following proposed actions:

1. Commercially thin or selective cut harvest in approximately 2800 acres of 30 to 120 year old stands with ground based, sky line, or helicopter yarding systems, as appropriate.

2. Construction of temporary roads or reconstruction and maintenance of older system roads to provide access for various management activities.

3. Reduce management created fuels or natural fuel accumulations through various methods such as hand and machine piling and pile burning or broadcast under-burning to lessen the fire hazard.

4. Precommercial thin about several hundred acres of adjacent managed plantations, and fertilize these stands if funds are available.

5. Manage or expand development in the Blue River, Mill Creek, and Mill Creek Overlook Rock Quarries to provide a variety of rock products for various management activities.

II. SUMMARY

A. RESOURCES CONSIDERED

This report documents the existing conditions and potential impacts to the soil and geology resource. The major short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity.

B. METHODS

The information for this report was obtained by intensive field reconnaissance of proposed units as well as the terrain surrounding the units. In almost all units, where ground based harvest methods were proposed, transects were walked and information taken to determine the numerical extent of existing compaction, as a percentage of the transect distance.

C. RESULTS

Anticipated direct effects to the soils resource will be within Willamette National Forest Standards and Guidelines. Recommended suspension requirements will control the potential for unacceptable displacement. Skyline yarding with one end suspension will be recommended for units or portions of units with side slopes greater that 30% to avoid excessive disturbance from heavy equipment. In one specific case, Unit 21 is located on very flat terrain, but has numerous wet soil areas. Full suspension is recommended on this unit to avoid excessive disturbance from equipment or cable yarding corridors. Potential nutrient loss will be controlled by duff retention standards. Slope instability is not considered a concern for any unit in this project area. Compaction will be controlled by designated skid or forwarder roads, the use of existing roads as much as possible, and subsoiling.

The field investigation indicated that none of the units as a whole exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted by compaction. Some units, like Unit 5 had relatively high levels, and some units like Units 9, 10 and 24 had high individual transect values that approach the standard. Usually, these were transects that crossed old landing sites. However, these two units as well as the others are, on average sufficiently below the threshold not to be considered a concern. One of the goals with entry into all these units is to provide the opportunity to subsoil the existing skid roads as much as is practical in order to reduce compaction to lower levels. With entry into any ground-based unit, evident skid or haul roads will be utilized before any new skid road is approved. It is possible with this proposed action that cumulative compaction in some portions of some units may exceed the threshold at the completion of harvest activities. Consequently, subsoiling is recommended enhancement to insure that cumulative levels remain below the 20% standard. In total all these units together would generate around 50 acres of enhancement subsoiling at an approximately cost of around $18,000. If some of these units are not included for harvest or if sufficient enhancement funds are not present for all units, then the dollars that are available will be distributed on a priority basis to the units with the greatest level of initial compaction, receiving the most attention.

D. CONCLUSIONS

The soils mitigation measures are designed to maintain long term soil productivity and provide a level of erosion control that is consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan (1990) and Oregon State Department of Environmental Quality guidelines. All prescriptions or mitigation measures discussed in this report are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (Pacific Northwest Region, November 1988). Prescriptions for soil protection and watershed considerations take into account past and predicted future land management activities. Standard contract language should provide sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate seed mix (BMP T-14, T-15, and T-16).

III. REGULATORY FRAMEWORK

A. LAWS AND REGULATIONS -- 36 C.F.R. 219.14(a) directs the Forest Service to classify lands under their jurisdiction as not suited for timber production if they fall into any of four categories:

a. Non-forest;
b. Irreversible soil or watershed damage (from NFMA 6(g)(3)(E)(i));
c. No assurance of reforestation within five years;
d. Legislatively or administratively withdrawn.

This report considers the first three categories of land. On the Willamette National Forest these areas are defined by landtype, which will be explained in much greater detail in the Procedures and Methodology Section.

B. REGIONAL GUIDELINES -- Forest Service Manual R-6 Supplement No. 2500.98-1 (Title 2520 Watershed Protection and Management) clarifies direction for planning and implementing activities in areas where soil quality standards are exceeded from prior activities; redefines soil displacement; provides guidance for managing soil organic matter and moisture regimes. In addition, the USDA FS Pacific Northwest Region handbook on General Water Quality Best Management Practices (November, 1988) provides a guide on practices which are applicable in conducting land management activities to achieve water quality standards to ensure compliance with the Clean Water Act, as amended, and Oregon Administrative Rules.

C. FOREST PLAN -- Chapter IV of the Willamette Forest Plan states the Forest-wide Standards and Guidelines for a variety of resources and activities. Soil and Water Quality protection are addressed in the section from FW-079 to FW-114. Based on direction in the Forest Wide Standards and Guides, FW-079 and FW-080 and BMP T-1, T-2 and T-3, the following activities were performed as part of the planning process: verifying the present SRI land type boundaries; determining the location of unsuited and unmanageable landtypes; prescribing slash treatment and suspension objectives for the possible units; and evaluating potential watershed impacts from management.

IV. DESIRED FUTURE CONDITION

The major short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. The total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings.

A. DISPLACEMENT --Displacement is defined as the removal of more than 50% of the topsoil or humus enriched soil horizons from an area of 100 square feet which is at least 5 feet in width. Displacement can occur with timber management during road or landing construction, yarding, or the mechanical treatment of slash, such as machine piling. Contract requirements which reduce or eliminate displacement are the primary way to minimize this concern.

B. COMPACTION -- Compaction is defined as an increase in soil bulk density of 15% or more and/or by a reduction of macropore space of 50% over the undisturbed soil. Excessive soil compaction from heavy, mechanized equipment used during logging can decrease soil productivity by restricting root growth, reducing rainfall infiltration rates, and increasing over land flow and run off. Prior management on some units, conducted before any requirements were established, created compaction conditions which may now approach or exceed the currently accepted standards and guidelines. Activities which minimize further compaction such as skyline logging, utilize existing compacted areas as much as possible, or reduce existing compaction through mechanical means (subsoiling) are recommended.

C. NUTRIENT LOSS --The primary mechanism for excessive nutrient loss is uncontrolled wild fire at high fuel loadings, low fuel moistures, and adverse weather conditions. Fire recurrence intervals of 100 to 200 years are apparent in the natural system, with shorter intervals in some critical high lightning areas or with suspected aboriginal burning. The actual thinning or harvest of these units is not as much concern for long term soil productivity as the concomitant slash accumulation and the potential for wild fire. On the other hand, NO ACTION IS NOT considered beneficial for long-term soil productivity either. Overstocked stands will rapidly see density increase, growth slow, and mortality rise. Fuel accumulations from blow down, snow down, and bug kill provide an ever increasing amount of fuel loading. Activities, which reduce stocking levels, improve stand vigor, and eliminate excessive fuel loading are favored.

D. INSTABILITY -- Slope instability is also a natural ecological component of the Cascade Range ecosystem. Debris chute failure recurrence is generally associated with more episodic large fire and / or flood events. Slump / earth flow instability is more steady state and may extend for centuries. Slope failures of either type carry large wood and rock to stream systems. This material is needed to both create suitable structure for sediment storage and provide the gravels required for fish and other aquatic habitat. On the other hand, numerous failures, without the associated boulder or log structure, can overload a system with sediment and destroy functioning habitat. Activities which do not exacerbate existing unstable areas or promote long-term stability are favored.

V. ANALYSIS METHODS

Field work was conducted intermittently through the fall of 2006 and the winter, spring, summer and fall of 2007. During that period, I conducted a field reconnaissance of potential harvest units and surrounding areas for a planned timber sale in order to help implement Willamette National Forest program direction. Specific field days included April 28, May 30, July 19, 21, and 24, August 18, September 27, October 14 and 30, and November 7, 14, and 28, 2006, and February 1, 15, and 21, March 8, 13, and 15, April 4 and 5, and June 7, 2007.

A. FIELD INVESTIGATION STANDARDS

A major portion of the field investigation was directed at distinguishing the various identifiable landtype components within the study area and mapping them on the photo overlays. Much of the landtype analysis referenced in this report was originally conducted for previous timber sale planning activities. In general, the field investigation confirmed some of the original 1973 SRI designations and the previously mapped work. The major portion of the field work involved site specific evaluation of existing conditions within each of the units. My field investigation of landtypes and the determination of the impacts from prior management activities formed the basis for the site-specific recommendations and mitigations that follow in this report.

B. LANDTYPES -- Description and discussion

1. Unsuited and unmanageable landtypes have been delineated within the project area as part of the landtype mapping process (FW-180). Unsuited and unmanageable landtypes occur in two basic categories - those acres that are un-regenerable and those where harvest will cause irreversible impacts. Those landtypes that are considered to have regeneration difficulties (BMP T-20) could include 1, 2, 3, 4, 5, 6, 7, 62, 210, 310, 610, and 710 or combinations of these landtypes. Almost all have numerous rock outcrops and cliffs, shallow gravelly soils with rock fragment content generally greater than 70%, and talus. Landtypes 6 and 7 are wet and dry meadows, respectively, and most areas of Landtype 6 are considered "wetlands" (BMP T-17 and W-3). All are currently considered noncommercial forestland or non-reforestable in the five-year time frame. Officially, 210, 310, and 610 are defined as marginally reforestable at least to extensive levels on easterly and northerly aspects, and non-reforestable in the five-year time frame on southerly and westerly aspects. However, almost no successful timber management has ever occurred on any aspect related to these specific landtypes on the McKenzie River Ranger District. Consequently, the north and east aspects of 210, 310, and 610 are considered unmanageable (no sufficient assurance of regeneration within the five year time frame) land in this report.

2. Landtypes considered unsuited because harvest will result in irreversible resource damage are primarily those that are actively unstable or potentially highly unstable (FW-105, BMP T-6). They could include the primary Landtypes 25 and 35, and the complexes of 255 (25 plus 35), 256, and 356. Landtypes 256 and 356 have actively unstable areas very closely associated and generally in direct contact with stream riparian areas or stream courses. These areas all commonly display slump type topography and include such features as tension cracks, bare soil scarps, leaning and fallen trees, sags and depressions, seeps, and disrupted drainages. Failure depths are such that root strength probably has little effect. However, the instability problem can be aggravated by timber harvest, as removing the trees tends to raise ground water levels due to the loss of evapotranspiration. This in turn reduces the soil strength and can cause increased or renewed instability. On the other hand, thinning these areas can create thriftier stands that have greater root strength and increased evaporation over time. Other landtype complexes that contain elements of 25 or 35, such as 225, 235, 251, 252, 253, 254 and 353 need to be evaluated on a case-by-case basis as management activities are proposed.

3. Landtype complexes, such as 15-16, 201-301 or 236-553-554 have elements of both or all landtypes that were either not differentiable at the photo scale, or sufficient field time was not available to distinguish the various components.

4. The remaining landtypes are adequately discussed in the Willamette National Forest Soils Resource Inventory. This document, first developed in 1973 and updated in 1990, was made to provide some basic soil, bedrock and landform information for management interpretations in order to assist forestland managers in applying multiple use principles. The 1973 text and descriptions are used here. A copy is on file with the Natural resources Staff group at the McKenzie River Ranger District.

C. BASIS FOR EVALUATING EFFECTS

For the soil resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the "unit", i.e. the stand polygon proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the "unit" affected. The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted.

VI. EXISTING CONDTION AND ENVIRONMENTAL CONSEQUENCES

A. INTRODUCTION

This project area is located within the Lower McKenzie drainage area and lies completely within the Western Cascades physiographic region. More specifically, these deposits are basaltic lava flows, flow breccias and pyroclastic deposits representing both early and later events of the Western Cascade volcanic sequence. In the western portion of the project area, these volcanic units are mapped by Walker and Duncan (1989) as "Tu", tuffaceous sedimentary rocks, basalt flows , and tuffs of Miocene and Oligocene age, approximately 32 to 17 million years old. In the eastern portion of this project area, these volcanic rocks are mapped by Walker and Duncan as "Tfc", basalt flows and clastic rocks from about 17 million to 10 million years old (19189). Also, Walker and Duncan (1989) map several large areas of "Qls" or landslide debris of Holocene or Pleistocene age in the Mill Creek area. This field reconnaissance determined that evidence for those landslide deposits is scant or not present, and they are likely moraine remnants. Interestingly, Legard and Meyer (1973) did not map any landslide deposits in this area either (Landtype 13). Nor did they map any glacial deposits (Landtypes 44 or 55) as they considered this entire basin primarily in-place, weathered volcanic soils. Suffice it to say that after much field reconnaissance, some small areas of landslide debris are present as are areas of weathered in-place volcanic rocks, but the large majority of this drainage is comprised of glacial deposits, such as outwash, ground, end or lateral moraine remnants.

In the last several million years, these rock formations have been extensively modified by stream erosion and mountain glaciation, especially with Pleistocene to Holocene glacial activity. Glacially derived soils are common in many units within this project. Ice cap glaciers probably covered the High Cascade platform many times during the Pleistocene, sometimes with sheets of ice hundreds of feet thick. During the early and most extensive glacial periods, valley glaciers surged away from the large ice mounds along the Cascade crest and traveled south and west down the McKenzie River drainage or north and northwest out the South Fork drainage, as they acted as outlets for excess ice accumulation for the large ice platforms along the Cascade crest. Whether these two extensive valley glaciers ever coalesced is difficult to determine without considerably more extensive field work. Late Pleistocene glaciations were likely much smaller and localized valley glaciers did not extend this far west along the primary river valleys. Little or no evidence can be found that the rugged peaks of Castle Rock, Deathball Rock or Thors Hammer contained small localized cirques, common to similar peaks, much farther to the east.

The rocks and glacial deposits of these younger Tertiary volcanic strata and Pleistocene drift, moraine, and fluvioglacial material are generally quite stable in this project area. Because of extensive glacial scour, most volcanic rocks are usually not well weathered at this point. Residual soils are often relatively coarse grained, occasionally rocky, and usually contain few clays. Soils developed from glacial deposits, even on the steeper side slopes are usually quite stable. Consequently, because of the gentle side slope slopes in the valley bottoms, the lack of very fine soil particles in most areas, especially the glacial and outwash soils, and the fact that glacial scour removed deeper pockets of fine-grained soils on much of the steep terrain, most soils are quite stable. These various volcanic land types are generally well drained where permeability is rapid in the surface soil and moderately rapid in the subsoil. On the other hand, the glacial and alluvial soils in the valley bottoms are very well drained, and permeability is rapid to very rapid in both the surface soil and subsurface soil layers. Because of high infiltration rates in the broad valley bottoms, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 30% on the gentler slopes to 40 to 80% on the steeper terrain. Offsite erosion is generally not a concern because of the vegetative ground cover, the high infiltration rates, and the gentle to moderate side slopes for many units.

Most of this project area was burnt by either natural or aboriginal fires that were likely prevalent and carried through much of the project area in the last several hundred years. Many areas may have been under burnt instead of stand replacement. Consequently, natural accumulations of down woody debris may not have been prevalent in many parts of this project area. These conditions would vary across the landscape, depending on aspect, elevation, and slope position.

B. ALTERNATIVES

All action alternatives and the no-action alternative will be evaluated for impacts to the soil resource. In this analysis, all the action alternatives have the same basic effects and the same soil protection measures, as described on a unit-by-unit basis, and will be considered similarly. Evaluating impacts and their potential significance between or among alternatives requires discussing the duration and intensity of those impacts. Often various words are utilized to describe those conditions. The following definitions apply to impacts described in this report.

1. Duration

- Short-term: The effects last for a few weeks to one or two years;
- Intermediate: The effects last from one or two years to about a decade:
- Long-term: The effects last from about 10 years to several score years or longer.

2. Intensity

- Low, negligible, little or no, minimal, minor: The impacts are essentially zero, at the lowest levels of detection, or very slight but still noticeable.

- Moderate, reasonable: The impacts are readily apparent, but meet standards and guides.
- Excessive, substantive, major, critical: The impact is moderately severe and likely approaches the upper limits of standards and guides.
- Significant, unacceptable: The impacts are severe, and likely exceed standards and guides or do not meet Best Management Practices.

3. Basis for Evaluation.

For the soils resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the "unit", i.e. the stand polygon proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the "unit" affected. The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives.

C. DIRECT AND INDIRECT EFFECTS

The major short-term, intermediate, or long-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. The following sections discuss in more detail (1) how the proposed action may affect the soil resource or (2) mitigations that can be utilized to avoid potentially undesirable effects.

1. No Action Alternative

Stands will continue to develop. Many of the stands proposed for thinning currently have little understory vegetation because of the lack of sunlight to the forest floor. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Blow down and snow down would continue to add fuel to the forest floor. In general, plant diversity would diminish as well as soil biota because of the lack of sunlight. Evidence of compaction from previous entries is still present in most ground-based units. In areas already compacted or disturbed by the initial entries, the soil building process will continue to return the soil to near preharvest conditions in the longer term. Short-term to intermediate term impacts from harvest, such as soil disturbance, dust (or mud), slash accumulation and disposal, and longer term impacts such as compaction and nutrient loss would not occur. Slope instability is not a geologic process that is active in this project area. Consequently, no effects to slope instability are anticipated whether the units are managed or not.

2. All Action Alternatives

All action alternatives have the same basic effects and the same soil protection measures, as described on a unit-by-unit basis. Some units may be evaluated that do not end up being considered in any action alternative.

A. Displacement

a) Existing Condition

Displacement occurs with three separate timber harvest activities: yarding, slash treatment, and road building and maintenance. Yarding activities on the existing plantations have for the most part occurred with the appropriate suspension requirements. Slash treatments usually maintained some amount of duff, though the current duff retention standards may not have been achieved. Some of the oldest managed stands may have been tractor piled. Tractor piling can result in both excessive disturbance and excessive compaction. Whether these two activities resulted in moderate to major detrimental impacts to productivity in some units is difficult to determine. Tractor piling has NOT been considered acceptable as a management tool for over 20 years on the Willamette National Forest. Stand, shrub and brush growth, as well as duff accumulation over the decades has provided an effective ground cover. At the point in time, little physical evidence can be found in any unit to indicate whether these two timber management activities resulted in significant, long-term detrimental soil displacement, off-site soil movement, or substantive loss of productivity.

Road development in this project area is extensive, and most large blocks of forest have been accessed. Most major road systems were constructed in the 1960s and 1970s with older road construction standards, though most all roads are located on stable benches, flats or ridges. The amount of new road construction slowed considerably in the late 1980s, and with subsequent entries reconstruction began to dominant. Newer roads, when required, were constructed to different and better standards. Road grades were steepened and pitched to better fit roads to the terrain. Cuts and fills were minimized, and drainage controls were added to promote long term slope stability. Most road cuts and fills have naturally vegetated over the years. Because the side slopes are relatively gentle and overland flow is limited throughout this project, erosion from roads is not generally considered a concern, except in a few localized areas.

NOTE: Some specific roading options will be discussed in a separate section that follows the Slope Stability review at this end of this long part of the document.

b) Environmental consequences

The logging suspension requirement for a proposed unit is mandated in the Land and Resource Management Plan to protect the soil from excessive disturbance or displacement (FW-107 and BMP T-12). The area near tail trees and landings is generally excluded from this suspension constraint. Unless otherwise stated or mitigated, all designated streams require full suspension or yarding away from the stream course during the yarding process (MA-15-27). To adequately protect the soil resource, the primary yarding objective for all units will be either ground based systems with predesignated skid roads and directional falling as appropriate, or skyline yarding with one end suspension, except at tail trees and landings. The primary factor differentiating these two yarding systems will be side slope.

Ground-based yarding systems may be employed on those acres in each unit where slopes are gentle enough (generally 30% or less) for ground-based systems. Ground based yarding systems, such as processor / forwarder, conventional line pulling or shovel, could be utilized in many units. All areas where ground based yarding might occur, are well away from active drainages, or skid roads will cross ephemeral swales only during dry periods and at right angles. All ground based yarding will require the B6.422 contract clause be strictly adhered to, and/or line pulling and directional falling will be implemented, as appropriate. In all cases, existing skid or haul roads will be utilized before any additional new skid or forwarder roads are developed.

Skyline yarding with one end suspension will be recommended for units or portions of units with side slopes greater that 30% to avoid excessive disturbance from heavy equipment. In one specific case, Unit 21 is located on very flat terrain, but has numerous wet soil areas. Full suspension is recommended on this unit to avoid excessive disturbance from equipment or cable yarding corridors.

In conclusion, disturbance from yarding will be well within the Regional and Forest standard and significant adverse impacts are not anticipated. With appropriate suspension during logging, soil disturbance is minimal and off site erosion is essentially non-existent. During harvest, the retention of stream adjacent trees and the requirement of full suspension yarding over or away from stream courses will minimize or eliminate off-site erosion.

NOTE: A more complete discussion of yarding suspension requirements and effects follows in the compaction section and can also be found in the unit summary tables.

B. Compaction

a) Existing Condition

The major source of compaction (and also much disturbance) is ground based skidding equipment. <u>Unrestricted</u> tractor yarding and tractor piling are <u>not</u> considered an option on those landtypes where sideslopes are gentle enough (generally less that 30%) to support tractor usage (BMP T-9 and VM-1, and FW-107). The silty nature of the fine-grained soils, and evidence that significant soil moisture is available most of the year indicate that any type of unrestricted tractor yarding and piling (even low ground pressure) would lead to excessive soil compaction and/or disturbance. Restricted tractor yarding from predesignated skid roads (B6.422 contract clause) is considered an option if the adversely affected area remains less than 20% of the activity area (BMP T-11). With tractor yarding, skid roads are predesignated, approved in advance of use by the Timber Sale Officer and generally 150 to 200 feet apart. With a processor/forwarder system the skid roads are usually only about 50 to 60 feet apart, but the number of trips for each individual road are substantially less than with skidding.

Extensive monitoring over many years has also shown that when designated skid roads are properly utilized in conjunction with line pulling and directional falling, compaction from ground-based tractor operations generally remains at about 9 to 13%. Residual compaction from the original harvest of these plantations needs to be considered.

Reducing the effective weight of the tractors and reducing the number of trips over a piece of ground are other means to reduce the risk of soil compaction and displacement. Yarding over frozen ground or over a deep, solid snow pack (24 inches of dense snow **or equivalent**) also substantively reduces soil disturbance and compaction (BMP VM-4). Over-the-snow yarding is encouraged for any of these units, as long as other resource objectives can be achieved, and sufficient snow accumulation is available. Monitoring of previous over-the-snow operations on various Districts has shown that essentially no displacement or compaction occurs, when it is properly implemented.

b) Environmental consequences

Evidence of compaction from previous entries is still present. Field reconnaissance through almost all the proposed units show some level of existing compaction. Oriented transects were walked through all the larger portions of possible tractor units. Transects were usually about 500 to 1000 feet in length, though both shorter and longer transects were walked. The results of the field investigation follow this paragraph. In no case was compaction measured directly. Heavily disturbed skid roads, landings or other areas where equipment tracks were evident are considered adversely compacted. Transects measure the amount of compacted ground along a line within a proposed unit. They were generally oriented to obtain information on management activities. They are not random, nor statistically representative of a particular unit. However, they do provide a strong indication of the degree of concern for the unit under investigation. In some cases multiple transects were walked in some units in different directions in order to provide more information, or to monitor and evaluate the initial results for accuracy. Ranges indicate some degree of uncertainty in the presence of compacted skid roads because of brush or other factors.

Unit No. Percent compacted along an individual transect.

2	13 to15
3	12, 15, and 12 to13
5	15 to17
6	14 to 15
8	12 to 13, and 10
9	18 to 20, 10 to 12, and 12
10	16 to 18, 13 to 14, and 6 to 8
18	north portion - 8
19	8
20	14 to 16 and 11 to 13
21	10 to 15, wet, difficult to evaluate
22	no information
23	14 to 16
24	18, and 10 to 12
30	8 to 10, estimate from reconnaissance
43	6 to 10
44	8 and 8
45	10
46	12 to 14
50	no information
61	10
62	10
67	10
95	8 and 10
96	8 to 10
97	15+
98	15+
99	12
103	no information.

The field investigation indicated that none of the units as a whole exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted by compaction. Some units, like Unit 5 had relatively high levels, and some units like Units 9, 10 and 24 had high individual transect values that approach the standard. Usually, these were transects that crossed old landing sites. However, these two units as well as the others are, on average sufficiently below the threshold not to be considered a concern. One of the goals with entry into all these units is to provide the opportunity to subsoil the existing skid roads as much as is practical in order to reduce compaction to lower levels. With entry into any ground-based unit, evident skid or haul roads will be utilized before any new skid road is approved. It is possible with this proposed action that cumulative compaction in some portions of some units may exceed the threshold at the completion of harvest activities. Consequently, subsoiling is recommended enhancement to insure that cumulative levels remain below the 20% standard. Based on previous experience, this effort should be successful. For example in previous activities with other units with past subsoiling, the overall compaction was reduced by about 5 to10% from initial levels.

Consequently, at the completion of harvest activities, some subsoiling is recommended for most ground based units in order to reduce compaction levels and improve overall productivity. Units 3, 8, 9, 10 19, 20, 22, 23, 24, 30, 40, 50, 61, 62, 67, 95, 96, 97, 98, 99 and 103 are primarily ground based and contain a total of over 600 acres. Assuming approximately 5% reduction in compaction, the equivalent of 30 acres could be subsoiled. At about $350 per subsoiled acre, this totals to over $10,000 of recommended enhancement. In addition, Units 2, 4, 5, 6, 15, 18, 26, 35, 36, 42, 43, 44, 45, 46, 47, 48, 49, 51, 54, 64, 66, 69, 72, 100, and 102 have portions of the unit which could be ground based while other parts are recommended for skyline, because of side slope constraints. These units total over 1000 acres. Assuming about one half the area is suitable for ground based harvest, approximately 500 additional acres might be available for ground based harvest. Again, assuming about a 5% reduction with subsoiling, this would generate about 25 acres of additional enhancement subsoiling at an approximately cost of just over $8000. In total, if all these units were considered in an action alternative, then about $18,000 is recommended for collection for enhancement subsoiling. If some of these units are not included for harvest or if sufficient enhancement funds are not present for all units, then the dollars that are available will be distributed on a priority basis to the units with the greatest level of initial compaction, receiving the most attention. In summary, with the use of designated skid roads, the reuse of the existing skid road system, and the subsoiling of primary landings and skid roads, compaction is not anticipated to exceed the 20% value in any unit and should be below the 15% level (or lower) in most units. Therefore it is not cumulatively significant. Subsoiling may be curtailed in some areas in order to reduce the amount of root pruning of leave trees and to avoid excessive amounts of exposed soil.

Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1% of the unit area. Skyline yarding with one end suspension is proposed for most or all of Units 1, 11, 12, 13, 14, 16, 17, 27, 28, 29, 31, 32, 34, 37, 38, 39, 52, 53, 55, 56, 57, 58, 59, 60, 63, 65, 74, 80, 81, 82, 83, 84, 88, 89, 91, 101, and 105. Most of these units had low existing compaction levels at generally less than 5% for these units. In addition, Units 2, 4, 5, 6, 15, 18, 26, 35, 36, 42, 43, 44, 45, 46, 47, 48, 49, 51, 54, 64, 66, 69, 72, 100, and 102 have moderate to larger portions of the unit which are proposed for skyline yarding with one end suspension because of side slope constraints. The more gently sloping areas could be ground based. Skyline landings are primarily planned at old existing landings, road turnouts, and road junctions. Little new spur road will be required. Consequently, cumulative effects from existing compaction and skyline yarding are not anticipated.

C. Nutrient Loss

a) Existing Condition

Many of the stands in this project area may have had an active fire history in the last 100 to 500 years or so, primarily with natural or aboriginal under burning. As a result, large expanses never had much down woody debris, or all of the accumulating down woody debris was removed by the fires. Many of the managed stands also had the initial harvests when PUM standards were in effect. This required that larger waste material (usually 8 inches wide and 10 feet long or greater) be removed from the units to reduce fire intensity. On the other hand, some of the oldest stands were harvested when utilization standards were low or absent, and this resulted in concentrations of large woody debris in some locations. In addition, most managed stands were broadcast burned which removed additional amounts of above ground organic matter. Consequently across numerous older managed stands, management generated, down woody debris or slash is at low levels, likely replicating the natural condition in many areas. Conversely, some localized areas have substantive accumulations. Younger plantations retained much more slash and large woody debris as was the current Forest plan direction. As a result, a wide range in the above ground tonnage of decomposing organic matter exists with amounts generally varying management history and fire intensity. The variety exists both between and within units.

b) Environmental consequences

Duff Retention objectives were specifically developed many years ago by the Willamette National Forest to apply to clear cut harvest prescriptions with broadcast burns on various landtypes with differing surface soil erosion potentials. Duff retention is the amount of duff thickness remaining after management activities are completed. For example, if average premanagement duff thickness was one inch, and approximately one half inch remained after broad cast burning, then duff retention would be 50%. When these standards were developed, duff retention on partial cut harvest prescriptions was not a significant issue, and none were formulated. Monitoring and field reconnaissance in recent years has shown that the duff retention percentages for under burns in partial cuts, thinnings, or fuels reduction within unmanaged stands, which maintain an intact live root mat and live canopy cover over most of the unit, could be less (to much less) and still achieve adequate soil protection. Having said that, actual duff retention measurements on under burns (both natural and management directed) on various Districts in the last few years indicate that the "broadcast burn" standards for duff retention are generally achieved, even if they are not specifically required. Consequently, they serve as a good goal and are recommended as a desired objective for the units in this report.

In the unit summary section, objectives for duff retention will be specified for each unit. For all action alternatives, within the managed plantations, slash will either be scattered in the units, piled and burned, or perhaps broadcast or under burned. Piling may occur by hand or with a grapple machine. Grapple piling occurs with a grapple not with a dozer brush rake. Grapple piling requires only one pass of the machine across the landscape, and the machine works while sitting on slash. Extensive monitoring of grapple machine piling operations indicates that little or no additional compaction or displacement occurs. On typical thinning, hand piles number about 40 per acre and occupy about 20 square feet per pile for a total of about 800 square feet per acre or about 1.8% per acre. Machine piles are substantively less in number, but correspondingly larger in size so that the 1.8 to 2% figure is maintained. In many cases only a few acres of any particular unit are hand piled or machine piled. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, pile burning is usually done in the fall or winter months when duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect and not cumulative because of the limited overall acreage involved.

Another aspect of long term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. Management activities will be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling (FW-085). At this time, site specific needs will be considered commensurate with wildlife objectives as outlined in FW-212a and FW-213a (as amended).

In summary, duff retention objectives will be provided on a unit-by-unit basis in the unit summary table. Concentrations of larger down logs that were produced naturally with the initial harvest should be left undisturbed as much as possible. Consequently, with the retention of adequate duff and woody debris, potential adverse impacts to long-term soil productivity are not anticipated.

D. Instability

a) Existing Condition

As was stated previously, this portion of the lower McKenzie drainage on the McKenzie River Ranger District is considered quite stable. Active slope instability from either debris chutes or slump / earth flow complexes does not usually occur. The recent intense rainstorms from 1996 to 2000 generated no in-unit instability within this project area, and only a few road failures were noted. These were primarily where culverts were overwhelmed or blocked with debris, and not because of soil or slope failure.

b) Environmental Consequences

Potential slope instability with proposed management is not considered a concern. No specific mitigation is proposed for these units, as none is needed.

E. Transportation Development

Some units may require temporary roads to access suitable landing sites for either ground based or skyline yarding systems. In all cases, these temporary roads are located on gentle stable side slopes in common material. Little or no full bench construction is required, and if needed, end haul of excess excavation will be required to a suitable waste area. For the most part, no active drainages are crossed. Some units are accessed by opening old logging roads constructed many decades ago. In most cases, use of these old roads will allow for drainage structure improvements and fill stabilization. Some units are accessed by using newer Forest Service roads that now require some additional work to maintain adequate road drainage and surface integrity. In summary, development of the transportation system for this sale will maintain slope stability, will produce little or no off site erosion, and will provide opportunity to rehabilitate old road courses.

Site specific discussions for access to various units follows:

1) Unit 39: The proposed spur climbs quickly from FS Rd. 1501 and is about 800 feet long. Most of the route, about 600 feet, is located on an existing old skid road on 10 to 30% side slopes, running along the contour at a primary slope break. The first 200 feet requires a steep favorable pitch with full bench construction on 40 to 70% side slopes in common material. The soils here are stable, and the recommended cut slope is 1:1. The excavated material, approximately 200 cubic yards, needs to be moved ahead to be used as a fill to construct the first landing. I am recommending that the first section be sensitive construct in order to control the location, the amount of excavated material, and its fill placement at the landing. This spur would likely be native surface with a standard operating season, and closed after logging activities are completed. The entire route is located within the proposed cutting unit, and no streams, floodplains or wet lands are involved.

2) Unit 43: Several options are available. The initial thought was to access a possible skyline landing on a side ridge near the west boundary by coming in from the north. This route is located on gentle side slopes between 0 and 10%. However, this access involves several wet soil areas and possible wetlands. Though feasible, it did not look desirable. Instead we located a route that comes in from the west. This route is also on gentle side slopes in common material on dry ground. It crosses a small stream / wet soil area for about 50 feet. This site would need a temporary culvert. This spur would be native surface with a standard operating season, and closed after logging activities are completed. The entire length of the spur is within the proposed cutting unit. Another option would be to avoid this area entirely. By using intermediate supports and adjusting the proposed unit boundary, it may also be possible to harvest all the skyline portion of this unit from a landing at the junction of FS Rd. 1501000 and Rd. 1501202. Since this is a rocked landing on an existing, well rocked road, a considerably extended operating season would be available.

3) Unit 51: Two options are available to harvest this unit. a) With the construction of an approximately 1000 feet of spur on gentle side slopes in common material, almost all this unit can be harvested by

ground based systems. All this route is within the proposed cutting unit, and most of this spur is located on an existing old skid road. This proposal would require a native surface road and dry season operation, usually considered July through September. The steeper ground along FS Rd. 1501700 would need to be directionally felled to the existing road or to gentler ground.

b) With this option, almost the entire unit would be sky line logged with partial suspension. A landing would need to be constructed on Rd. 700 at the northeast corner of the unit. Approximately 100 cubic yards of common material would be excavated from the cut bank and used to construct a 10 to 12 foot wide fill along the road for about 40 feet of distance. The fill slope is located on an approximately 30% to 35% side slope. Approximately, 10 to 20 cubic yards of pit run would be required to rock the constructed fill. Since this would be a rocked landing immediately adjacent to a well-rocked road, the operating season in this option could be a considerably extended season for this low elevation unit. This landing would serve as a turnout for the road at the completion of harvest activities.

4) Unit 55: This skyline unit has an excellent landing site on a broad stable bench at the top of the unit. Accessing this landing requires about 500 feet of spur road, most of which is not located within the cutting unit. The last 300 feet is on a broad, stable ridge with gentle side slopes in common material. The first 200 feet is somewhat more complicated. In order to leave the existing spur road (FS Rd. 1501702), grades in excess of 15% adverse are required to avoid undercutting the existing road, as side slopes here at about 45 to 70%. This will require truck assist for the haul. However, in order to avoid a switchback in large old growth timber on the bench, we steepened the grade to 22 to 26% adverse. This was done in order to avoid cutting numerous, large, old growth Douglas fir. Such grades are considered at the upper limit of truck assist, but are still feasible for this short distance with relatively straight alignment. This first portion of the route will be a full bench cut in common material on stable side slopes. The cut slope would be 1:1. It appears to avoid impacting any old growth timber. The excavated soil can be pushed ahead to be used as fill for the short section of road on the bench. Again, sensitive construct is recommended, primarily to control the location of this route, the amount of cut, and the placement of excavated material. This route would generally be considered a native surface road and standard operating season. At this point, the only other feasible option to harvest this unit, if the truck assist route is not utilized, is helicopter.

5) Langasher Road: The Langasher Road is the primary access road along the south side of the McKenzie River that runs east from near Finn Rock to Road 19, a distance of nearly seven miles. It accesses many of the units in this sale, and much of it is currently in poor condition. Considerable portions of this route are located on essentially flat sideslopes, and the road surface has chuck holes, swales and depressions in many areas. Several ephemeral and intermittent streams cross the road way at fords. Cross drains and stream culverts are few. During wet weather periods, ponded areas along the road way are common. It is proposed that the road way be raised about 12 to 24 inches along much of its length to provide a better road bed and improve road drainage.

The proposed road fill project can be divided into five segments.

Segment 1: Extends from Rd. 19 to Point A. No distance was measured. This segment is well rocked and was reconstructed with a previous timber sale. It would require some limited culvert work and spot rocking in a few critical areas. .

Segment 2: Extends for Point A to Point B. It is 1.2 miles long. Point B is located at a major spur road junction that access several units. Most of this section has large pot holes or water running across the road. It would require rocking or through fills to raise grade and improve drainage.

Segment 3: Extends from Point B to Point C. It is 0.9 mile long. Most of this section has large pot holes or water running across the road.

Segment 4: Extends from Point C to Point D. It is 0.7 mile long. The section from C to D includes a large number of units. Point D is located at a major spur road junction that access several more units. Most of this section has large pot holes or water running across the road. It would require rocking or through fills to raise grade in order to improve drainage.

Segment 5: Extends from Point D to FS Rd. 2618 at Quartz Creek. No distance was measured. Most of this section is located on private land and is well rocked. It would require some limited culvert work and spot rocking.

This segmentation assumes the following: All the units on the west side of the project area would haul from Point C to the west. All the units on the east side of the project would haul form Point B to the east. No haul would occur in the space between Point B and Point C. There are no proposed units located there The borrow site for the east side work is located about 0.1 mile south of Point B, in a large patch of scotch broom. The borrow site for the west side work is located somewhere between D and C in the unit (or units) that are located along both sides of the road in this section.

D. CUMULATIVE EFFECTS ASSESSMENT

For the soils resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the "unit", i.e. the stand polygon proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the "unit" affected. The major short-term impacts to soil productivity from harvest activity include displacement, compaction, nutrient loss, and instability. Forest-wide Standards and Guidelines FW – 081, Detrimental Soil Conditions, state that the total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings. In most situations, preventing soil impacts is the most effective and feasible way of reducing cumulative effects and ensuring long-term soil productivity.

The primary previous impact to the soil resource from management is compaction, the effects of which can remain apparent for decades. Potential cumulative effects from displacement, nutrient loss, and instability with previous management were not observed in the field reconnaissance. Existing compaction levels have been documented and discussed for the various units. The impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted. The soils mitigation measures are designed to limit the amount of additional compaction, and the subsoiling is intended to reduce compaction where levels would exceed standards and guides. <u>It is possible that some ground based units may approach the 20% standard at the completion of yarding, grapple piling, and pile burning.</u> No unit is anticipated to exceed the 20% standard in total, and units will be prioritized so that limited enhancement dollars will be expended on those units with the greatest anticipated cumulative effects from management. The objective is to remain below the 20% cumulative level, maintain long term soil productivity, and provide a level of erosion control that is consistent with State guidelines.

All prescriptions or mitigation measures discussed in this report are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (Pacific Northwest Region, November 1988). Prescriptions for soil protection and watershed considerations take into account past and predicted future land management activities.

At this time, no single unit measure of long-term soil productivity is widely used. Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship of short-term changes to long-term productivity is not fully understood at present. Experience indicates that the potential impacts on soils are best evaluated on a site specific, project-by-project basis. The major soils concerns - compaction, nutrient loss, displacement and instability - are most effectively reviewed, for both short and long-term effects, at the project level. With proper project implementation, as specified by my recommendations that immediately follow in the next section on mitigation measures and design standards, unacceptable cumulative effects on the soils resource are not anticipated from any of the action alternatives (BMP W-5). Consequently, the utilization of soil protection measures and best management practices as defined in this report will generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for a cumulative effects review, and no deviations are planned.

E. MITIGATION MEASURES, by unit and common to all action alternatives

The various proposed units are located on productive soils as localized unsuited areas of rocks and cliffs or potentially unstable areas were generally avoided, unless otherwise listed. Recent thinning on similar landtypes on this and other Ranger Districts has shown that 1) By avoiding sensitive landtypes, slope stability has been maintained after harvest; 2) With appropriate suspension during logging, soil disturbance was minimal and off-site erosion was essentially non existent; and 3) With appropriate contract language and enforcement, excessive compaction which results from unrestricted tractor yarding did not occur.

1. Soil Protection Measures

The following table discusses mitigations that would be necessary on a unit-by-unit basis. The information and recommendations were developed based on A) direction in the Forest Wide Standards and Guides (primarily FW-079, FW-090 and FW-179) to maintain or enhance soil productivity and stability, B) the field reconnaissance, and C) experience gained from extensive monitoring of similar projects. This data table addresses both suspension requirements and duff retention objectives, as well as pertinent specific comments for particular units (where necessary). The second list, that follows this table, has implementation mitigation measures that would also be applied to all units in any action alternative.

Unit	**SRI**	**Suspension**	**Duff Retention %**	**Comments**
1	201	Partial	60-80	Rocks along NW boundary
2	214, 44, 236	Partial, Ground	30-50	Wetland along north boundary. Yarding method depends on side slope. Implement B6.442 on ground based portions.
3	15-16	Ground	20-40	Implement B6.422. Wetland along west boundary.
4	201, 236	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.442 on ground based portions.

5	201, 236	Partial, ground	40-60	Yarding method depends on side slope. Implement B6.442 on ground based portions.
6	231-233, 212, 236, 44, 201	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.442 on ground based portions.
7	6			Wetland and hardwoods. Unsuited
8	15-16	Ground	20-40	Wetland along south boundary. Implement B6.422
9	15-16	Ground		Implement B6.422
10	15-16	Ground	20-40	Implement B6.422
11	201-301, 212	Partial	60-80	
12	201-301	Partial	60-80	
13	201	Partial	60-80	Rocks (unsuited land) in unit along NW and NE boundaries.
14	201, 201-301	Partial	60-80	Rocks at NW and E boundary
15	201-301, 15-16	Partial, Ground	50-70	Rocks along SW boundary. Yarding method depends on side slope. Implement B6.442 on ground based portions.
16	201	Partial	60-80	Rocks along SW boundary.
17	201	Partial	60-80	Rocks (unsuited) in unit at SW boundary.
18	201, 15-16	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.442 on ground based portions.
19	15-16	Ground	20-40	Implement B6.422
20	15-16	Ground	20-40	Implement B6.422
21	15-16	Full	50-70	Wet soil area, full suspension required to avoid excessive disturbance.
22	15-16	Ground	20-40	Implement B6.422
23	15-16	Ground	20-40	Implement B6.422
24	15-16	Ground	20-40	Implement B6.422
25	212, 201-301	Partial	60-80	
26	16-162, 201-214	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.422 on ground based areas.
27	201	Partial	60-80	
28	212	Partial	50-70	
29	201-214	Partial	60-80	Rocks at east boundary.
30	16-55	Ground	20-40	Implement B6.422
31	201-214	Partial	60-80	Rocks at north tip.
32	201-214, 443-447-553	Partial	30-50	
33	3-610, 644			Unsuited rock outcrops
34	214, 443	Partial	50-70	
35	16-55, 214	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.422 on ground based areas. Rocks at NE boundary.
36	55-234, 203-214,	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.422 on ground based areas.

				Rocks at SW boundary.
37	203-214	Partial	60-80	
38	44	Partial	40-60	
39	44, 214	Partial	50-70	
40	16-55	Ground	20-40	Implement B6.422
41	3-610			Rock Source – Mill Creek Rock Pit
42	214, 44, 55	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
43	201-214, 236-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
44	16-55, 44	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
45	236-553-554, 44, 55	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
46	236-553-554,	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
47	212, 236-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
48	201, 236-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
49	16, 605	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.422 on ground based areas.
50	16	Ground	20-40	Implement B6.422
51	16, 441	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
52	44	Partial	40-60	
53	44	Partial	40-60	
54	443-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
55	214, 443-553-554	Partial	40-60	
56	201-214, 204	Partial	60-80	Some rocky soil areas.
57	201, 204	Partial	60-80	Some rocky soil areas.
58	443, 55-234	Partial	40-60	
59	55-234, 443	Partial	40-60	
60	443, 212	Partial	50-70	
61	55	Ground	20-40	Implement B6.422
62	55	Ground	20-40	Implement B6.422
63	201	Partial	60-80	
64	55-233, 201, 214	Partial, Ground	50-70	Yarding method depends on side slope. Implement B6.422 on ground based areas.
65	201, 214	Partial	60-80	
66	214, 236-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
67	55	Ground	20-40	Implement B6.422
68				
69	55-234, 55, 443	Partial, Ground	30-50	Yarding method depends on side slope. Implement B6.422 on ground based areas.
70				
71	15-16			Borrow site for fill material

72	164, 214, 443-553-554	Partial, Ground	40-60	Yarding method depends on side slope. Implement B6.422 on ground based areas.
73				
74	44	Partial	40-60	
75				
76				
77				
78				
79				
80	201	Partial	60-80	
81	201	Partial	60-80	
82	212, 236	Partial	50-70	
83	201	Partial	60-80	Rocks at SW boundary.
84	201, 201-214, 214	Partial	60-80	Unit surrounds rocky meadows.
85	3-210			Rocky, open meadows.
86	3-210			Dry meadows with rocks
87	3-210			Rocky unsuited areas
88	201	Partial	60-80	Rocks in unit and at NE boundary.
89	201	Partial	60-80	Rocks at SE boundary.
90				
91	44	Partial	40-60	
92				
93				
94				
95	15-16	Ground	20-40	Implement B6.422
96	15-16	Ground	20-40	Implement B6.422
97	15-16	Ground	20-40	Implement B6.422
98	15-16	Ground	20-40	Implement B6.422
99	15-16	Ground	20-40	Implement B6.422
100	13-16	Partial, Ground	20-40	Yarding method depends on side slope. Implement B6.422 on ground based areas.
101	13-16	Partial	30-50	
102	13-16, 15-16	Partial, Ground	30-50	Yarding method depends on side slope. Implement B6.422 on ground based areas.
103	15-16	Ground	20-40	Implement B6.422
104	3-610			Mill Creek Overlook Rock Source
105	201	Partial	60-80	

NOTES:
A) **Some units (or portions there of) that were reviewed in the field reconnaissance and discussed in this report and the unit summary section may not be included in any action alternative, or have been combined with other units. They are included to document the work that was accomplished.**

B) Partial means skyline logging with one end suspension and full suspension over draws and drainage courses. The area at tail trees and landings is excluded. Ground means a ground based system such as tractor, shovel or processor / forwarder.
C) These Duff Retention objectives were specifically developed to apply to clear cut harvest prescriptions on these particular landtypes. The percentages for partial cuts, thinnings, or underburns of unmanaged stands, which maintain an intact live root mat and canopy cover over most of the unit, could be less (to much less) and still achieve adequate soil protection. Duff retention monitoring in the last few years on underburns on various Districts indicates that these levels of duff retention are generally achieved, even if they are not specifically required.

D) Several units are planned for harvest with helicopter yarding. This is done to reduce the development of a transportation system that would be needed for conventional logging and is not required for adequate soil protection.

2. Site Specific Mitigation Measures -- common to all action alternatives

a) Ground-based equipment should generally operate in the dry season, usually considered from May through October, unless otherwise restricted by other resource concerns or waived by Forest Service personnel.

b) Where operable, harvested trees should be topped and limbed in the units in order to provide small limbs and needles for nutrient recycling. This objective has to be tempered with the need to reduce fuel loading to control potential wild fires, and to meet site specific standards for slash loadings.

c) Horses and ground -based equipment are usually limited to side slopes less than 30%, unless otherwise directed by Forest Service personnel, in order to reduce soil disturbance.

d) Ground-based skidding equipment shall stay on designated skid trails. Ground-based skid trails will be predesignated and preapproved before use (B6.422). Existing skid roads should always be used before new skid road locations are approved. They should not usually exceed 15 feet in width, and the objective is to maintain a 10 to 12 foot width throughout the length. Where practical the skidder, cat, shovel or forwarder should travel on slash. Traveling on slash has been shown to reduce off site soil erosion or lessen soil compaction. Skid roads will generally be 100 to 200 feet apart with conventional line pulling operations, and 40 to 60 feet apart with processor / forwarder operations.

e) Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the gentle to moderate slope of the terrain, small sections of ground lead may occur in some areas, and this is acceptable.

f) The reopening of temporary, unclassified roads should usually occur in the dry season, generally considered May through October to avoid surface erosion from exposed soil (unless directed otherwise by Forest Service personnel). Open roads should be storm proofed if they have to set through extended periods of wet weather.

g) Where practical, at the completion of harvest activities, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off site soil erosion.

h) Unclassified or temporary roads used outside the standard operating season, should generally be rocked, snow covered, or frozen to reduce the potential for erosion, unless other mitigating or extenuating circumstances are present.

i) Cable corridors spacing should be set to both minimize damage to standing timber, as well as the under lying vegetation and soil.

j) Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be dropped into the stream if possible to aid in woody debris recruitment.

k) Avoid disturbance to the existing large down woody debris concentrations created by the initial entry as much as practical.

l) At the completion of harvest activities, spur roads, tractor skid roads or forwarder roads should be water barred and scarified, as is necessary. Where possible, skid roads and landings should be subsoiled in order to reduce compaction and return the site to near original productivity. Subsoiling needs to be considered in light of the potential for root pruning, damage to existing regeneration, and the increased amount of soil disturbance.

F. MONITORING REQUIREMENTS

As the proposed project is carried out, it will be monitored to evaluate implementation efficiency, prescription adequacy, and to update sale area rehabilitation needs or protection. Primary implementation monitoring will be conducted at the contract administration phase of the project by the Timber Sale Officer. The logger will be required to maintain adequate suspension during the harvest process, to remain on designated skid roads and landings with equipment, and to limit the number and extent of skid road utilized. In addition, a host of other contract requirements dealing with such items as erosion control, hazardous material use, fire restrictions, etc. will be enforced. Duff retention will be monitored as part of any post sale activity that may affect the soil resource, such as spot or pile burning, grapple piling, or broadcast burning.

VII. CONSISTENCY WITH DIRECTION AND REGULATIONS

A. STANDARDS AND GUIDELINES

Prescriptions for soil protection, watershed considerations and riparian needs of the sub-basin take into account past and predicted future land management activities. The soils mitigation measures are designed to provide a level of protection and erosion control that is consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan (1990). On site sedimentation is anticipated to be within National Forest and Oregon State Guidelines. All prescriptions or mitigation measures discussed in this report are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (Pacific Northwest Region, November 1988). Standard contract language should provide for sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate seed mix (BMP T-14, T-15, and T-16).

Other applicable Standards and Guides and/or Best Management Practices may exist which were not directly referenced in this document. Their exclusion does not indicate that they were overlooked or are inapplicable. As project development proceeds, appropriate constraints or mitigations may be added or changed in order to better meet the intent of adequate resource protection or enhancement as directed in the 1990 Willamette National Forest Land and Resource Management Plan and Final Environmental Impact Statement.

B. IDENTIFICATION OF IRREVERSIBLE OR IRRETRIEVABLEE RESOURCES

No irreversible and /or irretrievable use of the soils or geology resource is anticipated, beyond that which has been previously identified in the Willamette National Forest Land and Resource Management Plan, as amended. Road or landing aggregate, either crushed or pit run, that might be required for this sale could come from various rock sources. Development could occur within the Blue River, Mill Creek, and Mill Creek Overlook Rock Quarries to provide various rock products for road maintenance and road reconstruction associated with the harvest and haul needs. Minor clearing, generally of less than one acre for any individual pit could be associated with the development of any of these rock sources. Clearing could include managed stand trees in plantations or brush, or adjacent snags and danger trees.

C. CONSULTATION WITH OTHERS - Logging systems work was done on several units in conjunction with Dan Fleming, Logging Systems Specialist on the McKenzie River Ranger District. Some unit development, especially in the west part of the project area and north of Hwy. 126, was conducted and evaluated in the field with Shane Kamrath, Wildlife Biologist, and Mei Lin Lantz, AFMO and Fuels Specialist. The Langasher Road reconstruction proposal was developed with considerable input from Dave Kretzing, District Hydrologist.

VIII. REFERENCES CITED

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Respectfully submitted,

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Fire and Fuels Analysis
for
Bridge Thin EA
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Mei Lin Lantz

I. Introduction

This document describes the Fire and Fuels direct, indirect and cumulative effects for the Bridge Thin EA Proposed Actions on the McKenzie River Ranger District, Willamette National Forest. The Bridge Thin EA Purpose and Need describes improving stand conditions in terms of species composition, density, and structure over the long term in previously managed stands up to 80 years of age and in fire regenerated stands generally up to 120 years of age. The amended Willamette Forest Plan includes goals and objectives for managing stands with silviculture techniques to maintain stand health and vigor and provide multiple use benefits, moving the project area toward the desired future conditions. Therefore, actions are needed within the project area that would:

- Restore structural diversity in stem exclusion stands to enhance wildlife habitat;
- Accelerate late-successional conditions for stands within riparian reserves;
- Restore “open oak savannah” stands where they were historically present;
- Restore degraded roads infra structure;
- Protect and maintain water quality and reduce hazardous fuel levels in the watershed for communities in the wildland-urban interface;
- Improve the role of fire as a natural disturbance process in the ecosystem.

The Purpose and Need list specific actions to be evaluated for fire and fuels. This document will express the direct, indirect and cumulative effects from the following actions:

- Manage activity-created and natural fuels by underburning, machine piling, hand piling, and broadcast burning, to restore historical fire regime processes and to meet the Forest Plan Standards;
- Treat areas to improve defensible space within the wildland urban interface.

One non-significant issue that relates to fire and fuels in Bridge Thin Project Area is based on Wildland Urban Interface (WUI) and the Lane County Community Wildfire Protection Plan (CWPP). The Bridge Thin Project Area surrounds private land along the McKenzie River, the town of Blue River, the development of Rainbow, and several groups of homes and structures. These areas are considered WUI and because they are in Lane County, they are part of the Lane County CWPP. This CWPP was developed in 2005 by the Oregon Natural Hazards Resource Committee and adopted by Lane County. The implementation of this plan has not begun in all communities in Lane County yet the locations of Bridge Thin treatments coincide with the WUI and will be discussed.

Global climate change is another non-significant issue that involves fire and fuels. Forests are considered sinks for carbon and many references refer to the potential of large wildfires to be detrimental to our global climate (JFSP, 2007). The scale of analysis is large for climate change and many of the factors are still being researched and evaluated. The reduction of hazardous fuels and the reintroduction of fire help reduce the severity or size of future wildfires which could aid in reducing the combustion of sequestered carbon in trees.

II. Summary

This analysis shows the direct, indirect, and cumulative effects of using prescribed fire and reducing hazardous fuels. The use of prescribed fire will aid in returning the disturbance process historically present in this ecosystem. Additionally, this analysis explains how the fuels treatments (reducing fuels) through underburning, piling and burning, or chipping following commercial harvests will reduce the potential for wildfire effects in and near the area treated. Fuels treatments will reduce the hazardous fuels on the vertical and horizontal profile at the stand level and across the project area, thus reducing the potential wildfire severity. Additionally, underburns or fuels treatments are proposed in units that receive no commercial harvest. These units are located in the Wildland Urban Interface (WUI) and aim to provide safety for firefighters and support protection of structures during potential wildfires. Fuels treatments will meet Forest Plan Standard and Guidelines to reduce hazardous fuel loading while meeting air quality regulations.

III. Regulatory Framework / Management Direction

1. Willamette National Forest Land and Resource Management Plan (Forest Plan) FEIS and Record of Decision (ROD) establishes Management Standards and Guidelines (S&G) for treatment, maintenance, or reduction of hazardous fuels to achieve the desired future condition.
2. The Oregon Smoke Management Plan and the State Implementation Plan regulate the standards set by the 1990 Clean Air Act and 1977 Clean Air Act and its amendments. The Willamette National Forest closely follows this plan to maintain air quality standards during prescribed fire treatments and wildfire.
3. Wilderness Act established policies in the Forest Plan for reducing particulate matter intrusions from July 1 – September 30 each year. These S&G are managed in prescribed fire planning to reduce intrusions into the Wilderness especially during this time frame and work with Smoke Management Forecasters prior to burning.
4. The National Fire Plan (NFP), developed in August 2000, identifies five key points and two apply to this project: *Key point 3 – Hazardous Fuel Reduction* and *Key point 4 – Providing Community Assistance.*
5. McKenzie River Ranger District follows The Northwest Oregon Fire Management Plan – an interagency plan established to provide additional guidelines for prescribed and wildfire activities.
6. A detailed, nationally approved Interagency Prescribed Fire Burn Plan is a requirement for any activity involving prescribed fire. This plan identifies management objectives specific to the Forest Plan, details about the stand to be burned, prescription parameters, contingency, safety hazards and mitigations, and public notification. The District or Forest Line Office is required to sign and approve the burn plans before implementation.

IV. Sequential flow of information and analysis

The McKenzie River Ranger District Interdisciplinary Team (IDT) identified and analyzed the Purpose and Need and Proposed Actions. Information from the IDT was used to suppport modeling and analysis for predicted fuel loading. Fire behavior, Fire

Regime Condition Class, changes in WUI areas, and air quality particulate emissions were then calculated using models at large and project level scales.

V. Desired Future Conditions (DFC)

Forest Plan Standards and Guides (S&G) establish levels of allowable woody material following timber harvest. Two specific guidelines related to fire and fuels are Forest Wide (FW) 212 and 252 which state 7-11 tons/acre of 0-3" diameter fuels in stands post-harvest. These guidelines are to enable better control of wildfire, performed safely by firefighters, because the conditions limit flame length and thus fire behavior. The DFC in the Bridge Thin Project Area also aims to return the natural role of fire as a disturbance process on the landscape. Over time implementing proposed fuels treatments, especially underburns will make steps toward changing Fire Regime Condition Class (FRCC) from FRCC 2 to a desired FRCC 1.The desired condition of the Oregon white oak (*Quercus garryana*) proposes to reduce the encroaching conifers in the area through prescribed fire underburns. This fuel treatment will aid in allowing shade intolerant oak to grow unhindered by more rapid growing conifer trees. Underburns in the oak should continue over time to maintain the historical conditions of this unique and rare habitat.

VI. Analysis Methods

For terminology and descriptions please refer to Attachment F1.

A. Models and Data

The following is a list of models and analysis techniques used for this report:

- ArcMap/GIS – program to utilize spatial data for fuel models, vegetation, FRCC, alternatives, etc. Data was gathered on the ground or from Willamette NF, FSVeg, LANDFIRE, and NW Oregon FRCC corporate GIS layers.
- BehavePlus 3.0 – program to determine a range of fire behavior characteristics including surface fire and passive or active crown fire to show how desired treatments change or reduce the intensity and severity of wildfire; change or reduce the effects from wildfire.
- Fire Behavior Prediction System Fuel Models (FBPS) – photo and data reference for quantifying fuel types.
- Fire Regime Condition Class (FRCC) – Northwest Oregon GIS coverage (from LANDFIRE) that determines stand characteristics and historical/current fire regimes. The current vegetation is from a combination of GIS vegetation queries, aerial photos, and local knowledge.
- FOFEM – program used to determine the range of fire effects, including effects on soil, trees mortality, smoke emissions, etc.
- LANDFIRE – Nationally consistent data of fuel models, FRCC, etc. that can be altered to fit a particular area.
- Photo Series for Natural Forest Residue for PNW– used to identify current fuel loading in Bridge Thin Project Area. (Maxwell, et.al. 1980). Forty new fuel models are also available (Scott and Burgan 2005) but this analysis used the Standard 13.

- PredictDAS – local spreadsheet formulated by Darryl Ashcraft, a retired FS employee, using calculations from Handbook to Predicting Residue Weights of Pacific Northwest Conifers (Snell & Brown 1980) to predict post-harvest fuel loading.

B. Basis for characterizing conditions

Fuel loading on the vertical and horizontal profile is the basis for characterizing the fire behavior across the landscape. Fire behavior is analyzed at the stand level and expanded across the landscape based on topography, weather, and fuels. Changes in FRCC show the reintroduction of fire as a disturbance process across the landscape. The stratum FRCC allows for fire to be evaluated across an area it may naturally occur (without suppression efforts). Stratum FRCC is evaluated first and then stand FRCC is evaluated more at a field level using relationships between current seral stages. Stand FRCC allows assessment of treatments at a specific level so that proposed treatment can be evaluated at the smaller scale (Kertis et al. 2007 and Hann et al. 2001). WUI areas are defined more intricately at the field level due to locations of structures but GIS mapping was done to show a WUI boundary that extends from the structure 1.5 miles out (Silvis, website). Air quality measures are based on particulate matter emissions during the fuels treatments and potential intrusions into populated areas or Wilderness.

C. Basis for evaluating effects

The key measures used to analyze fire and fuels effects are: fuel loading in 1, 10, and 100 hour fuels size classes, crown base height (CBH), and fuel continuity horizontally and vertically across the landscape. Measurement criteria are consistent with the Forest Plan S&G. For pre-harvest fuel loading photo series were used to identify tonnage of fuel currently in each stand. For post-harvest fuel loading silviculture stand exams were used with the *PredictDAS* spreadsheet to identify potential fuel loadings. Prior to fuels treatments fuels will be identified on the ground using transects and/or photo series to gather specific fuel loading. Air quality analysis was based on the guidelines the Willamette NF follows. Particulate matter (PM) was evaluated with the potential fuel loadings post harvest. Prior to work on the ground PM will again be modeled to assure compliance with Air Quality regulations.

D. Scale of Analysis

This report identifies direct, indirect effects within the proposed treatment areas of 2,518 acres. The cumulative effects are analyzed the Bridge Thin Project Area of 20,657 acres. The project lies within the Quartz/Minor Watershed, a subwatershed in the Upper McKenzie River Watershed. Specific field data within the Project Area was gathered as stated above. Models were used that included project data and data from the large landscape level due to the nature of fire as a disturbance and how it moves across the landscape. To identify specific effects of fuels treatments, models zoomed into the area using field information and landscape level data.

VII. Existing Condition

A.1. Existing Condition - Fire on the Landscape

Fire has and will continue to play an active and vital role in our forest ecology. Historically, across the Willamette National Forest, fire created mosaic patterns within the vegetation as it occurred at different times in the year or locations which affected the intensity and severity of the fire. Fires were often caused by lightning, and there are references and stories of local Indigenous people historically using fire for managing resources and travel routes (Teensma 1987). Fire affects forest ecology in multiple ways through distribution of active ectomycorrhizal short roots, changes in forest vegetation structure, and diversifying areas for wildlife. Fire is a natural disturbance and the influences of human actions (development and resources) over the past century warrant management activities to aid in maintaining, providing, and reducing hazards. Teensma studied fire history in an area adjacent to Bridge Thin Project Area. The MRFI that he analyzed ranged from <100 years to 166 years.

VII.A.2 Existing Condition - Past Management

Past management activities that have changed the fuel profile or fire behavior are grazing, timber harvesting, fuels treatments following timber harvests, and fire suppression. In 1920 management in National Forests began suppressing fires and managing for resource products which altered the natural regimes of fire. Over the past 36 years from 1970-2007 46 fires occurred in the Bridge Thin Project Area. All fires were suppressed and most were contained to less than one acre with the largest recorded at 5 acres. Lightning accounted for about 30% of the fires in the Project Area and the others were human-caused. Based on the recorded data from Willamette National Forest, the fire frequency is 1.24 fires per year which implies that fire is a disturbance process in the forest ecosystem.

Grazing occurred through the Upper McKenzie Valley from the 1800’s to 1948 (UMWA 1995). Grazing reduced fuels in the open meadow areas and curtailed regeneration of many conifer species. Currently many of these open areas have transitioned to encroaching conifers among the grass and oak or into conifer dominated stands. Many of the proposed Bridge Thin units have been previously managed. Earlier commercial harvest, mostly regeneration harvests, left non-merchantable large woody material and fuels were not treated. Later harvest methods included yarding merchantable material and broadcast burning. Prior to the 1970’s, the scale of acres treated was much larger than the more recent practices. The number of acres harvested within the past 60 years in the Bridge Thin Project Area is approximately 2,848 acres. No natural fuels prescribed fire (prescribed fire without timber harvest) has occurred in the Bridge Thin Project Area in the past 50 years.

Teensma’s Dissertation shows how the natural fire rotation changed from times during Indigenous (Aboriginal) community, Anglo-settlement, and current fire suppression.

- 1772-1830 at 78 years
- 1851-1909 at 87 years
- 1910-current 587 years

VII.A.3. Existing Condition - Fire Regime Condition Class

Fire Regimes describe the natural frequency fire occurs across the landscape pre-settlement and includes the historic aboriginal use (Agee 1993). Five Fire Regimes are used at the national level Fire Regime I, II, III, IV, and V (Schmidt et al. 2002 and Hann et al. 2004). Within the Bridge Thin Project Area the following Pacific Northwest Region 6 Fire Regimes have been classified:

- Fire Regime I – < 0-35 year fire return interval; low severity
- Fire Regime IIIa – < 50 year fire return interval; mixed severity
- Fire Regime IIIb – 50-100 year fire return interval; mixed severity
- Fire Regime IIIc – 100-200 year fire return interval; mixed severity
- Fire Regime V – 150+ year fire return interval; high severity

Of importance in the Fire Regimes description is the use of mixed severity. This term on the Willamette NF explains the varying degrees of fire intensity that can occur given the topography, vegetation, and the ability of larger trees to withstand the intensity creating different levels of mortality. Mixed severity fires are not stand-replacing but rather create a patchy mosaic of different mortality across the landscape (Kertis et al. 2007).

In addition to the frequency and severity, fire disturbance is categorized into Fire Regime Condition Class (FRCC). FRCC describes the degree of departure of current vegetation from the historic fire regime and helps to establish reference and evaluate risks to the ecosystem (Hann, et.al. 2001). FRCC 1, 2, and 3 rank the degree of departure:

- FRCC 1
  - Fire regimes near historic range (departure is no more than one return interval)
  - A low risk of losing key ecosystem components
  - Vegetation attributes are functioning within historical range
- FRCC 2
  - Fire regimes have been moderately altered from historical range; moderate changes in fire size and intensity has resulted
  - Moderate risk of losing key ecosystem components
  - Vegetation attributes have been moderately altered
- FRCC 3
  - Fire regimes have been significantly altered from their historical range; dramatic changes in fire size and severity has resulted
  - Severe loss of ecosystem components
  - Vegetation attributes have been significantly altered

As stated in the document from the NW Oregon FRCC workgroup, FRCC evaluation is conducted by identifying the plant communities (biophysical settings, BpS) that would exist given the soils, climate, topography, and the natural disturbance regime. This is followed by identifying current vegetation in five seral stage categories (early, mid-closed, mid-open, late-open, late-closed). The percentage change in each seral stage across the stratum shows the change or departure from historical seral stages that existed in the historic fire regime. The stratum FRCC allows for fire, as a landscape level disturbance, to be evaluated across an area it may naturally occur. Stratum FRCC (4-6th field watershed) was evaluated first and then stand FRCC was evaluated more at a field level using relationships between current seral stages (Kertis et al. 2007 and Hann et al. 2001).

Insert maps of Fire Regimes and FRCC stratum!

Bridge Thin Project Area is categorized as a FRCC2 and concludes the area is moderately altered from the historical range of variability for fire interval; a moderate change in fire intensity and severity has resulted (Kertis et al. 2007 and Hann et al. 2001). Additionally, susceptibility to fire within the Bridge Thin Project Area should be tempered with the current continuous horizontal and vertical fuel profile, the main highway travel route, and the development of community and structures. An elevated risk of high severity fire due to the continuity of horizontal and vertical fuels exists across the area. Continuous canopy closure and increased fuel due to fire suppression create more of a potential for unnatural, severe fire.

VII.A.4. Existing Condition - Fuel Profile

Fuel models describe the fuel profile in the Bridge Thin Project Area. Fuel models are a quantitative way to describe surface fuel loading (amount of fuel in tons/acre), arrangement, structure, and calculate predicted fire behavior. The primary fuel that carries the fire is the general classification fuel models, i.e. grass, brush, timber litter, or timber slash. Fuel loading and depth correlate to the fire intensity and rate of spread. Horizontal fuels refer to ground or surface fuels, while vertical fuels refer to the ladder fuels such as limbs on the bole of trees, crown base height (CBH), regeneration, and brush.

Fuel loading and fuel models are described below. Both are used to calculate and predict expected fire behavior. Fuel loading is measured using size of fuel that relates to time frames based on how the fuel responds to moisture (how long it takes to dry and become consumable) and are then quantified using tons/acre. Measurements for fuel loading are:

- 0” – .24” diameter or 1 hour fuels
- .25” – .99” diameter or 10 hour fuels
- 1.0” – 2.99” diameter or 100 hour fuels
- ≥3.0” diameter or 1000 hour fuels

The Bridge Thin Project Area is composed of the following natural fuel models (FM):

- **FM 1**– Representative of grass meadows or openings. Fuel loading in the 0-3 inch diameter fuels is less than 1.5 tons/acre. Less than one-third of the area contains trees or shrubs. Fire spreads quickly in this fine fuel when it is cured or nearly cured. *Example – open oak savannah above Highway 126.*
- **FM 5** – Representative of timber plantations and natural regeneration between two and 10 feet tall. *Ceanothus velutinus* is the common understory brush. Shrubs or grass in the understory can carry the fire. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 3.5 tons/acre. *Example – second growth units under 30 years old that have trees ≤35’ tall and a shrub component along the 1501 or 2633 Road.*

- **FM 8 –** Mature short-needle conifer stands with light fuel loading in the 0-3 inch diameter fuels. This profile can be found in stands that were or were not previously harvested. Fire spread is generally slow with low flame lengths. Heavy fuel concentrations (jackpots) can flare up. Fuel loading in the 0-3" diameter for live and dead fuel is less than 5 tons/acre. *Example – area along Langasher Road with few understory shrubs or regeneration.*
- **FM 10 –** Representative of mixed conifer stands with heavy concentrations of large down wood, > 9" diameter. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 12 tons/acre. Ground fire behavior is higher in intensity than fuel models 8 because of the heavier fuel loading and the ladder fuels. Torching of trees (fire in the crowns of trees) occurs more frequently. *Example – units on the south side of King Road on the SE portion of Bridge Thin Project Area.*

Private land has FM11 and 12 (but they were not analyzed on the ground). These FM will also explain fuels post harvest on National Forest land.

- **FM 11 –** Light slash load resulting from light to moderate partial cuts or harvests which yard tops of trees attached to the last log. Fuel loading in the 0-3" diameter for live and dead fuel is <12 tons/acre. The continuity of the slash can increase fire behavior.
- **FM 12 –** Moderate slash loads resulting from moderate or heavy partial cuts. Fuel loading in the 0-3" diameter for live and dead fuel is < 35.6 tons/acre. Fire behavior can be rapidly spreading, especially with red needles still on the branch wood.

Table F1 below summarizes the acres of each Fuel Model on National Forest Land using the FSVeg.

Table F1: Existing Condition - Fuel Model within Bridge Thin Project Area

	FM 1	FM 5	FM 8	FM 10
Acres within Bridge Thin Project Area	471 Ac	5092 Ac	9015 Ac.	5833 Ac.

The term hazardous fuel is used in current publications, such as the National Fire Plan, and describes the current and potential hazardous fuels in the Bridge Thin Project Area:

- fine fuels (1, 10, and portions of 100 hour) generated following timber harvest and in forested areas that have been excluded from disturbance processes;
- vegetation structure with fine fuels on the ground, shrubs and small trees in the understory, lichen on larger trees, and tight canopy closure all contributing to rapid horizontal and vertical movement of fire;
- continuous fuel near structures that could easily cast embers onto the roof.

VII.A.5. Existing Condition - Fire Behavior

The Bridge Thin Project Area has a fire frequency of 1.24 fires per year. This shows that fire continues to occur naturally in this area. Fire behavior is a result of the fuels, topography, and weather conditions. Fire behavior was modeled using BehavePlus3 with fuels and topography inputs that correspond to the Bridge Thin Project Area and summer fire weather data representing the hot, dry fire weather (97^{th} percentile) similar to 2003 and 2006 is used to represent conditions where fires can escape initial attack and threaten areas in WUI or other resource values. Areas with light fuel loading, such as FM 8, exhibit low intensity fires with low severity (low mortality of dominant vegetation). Fuel Model 10 exhibits high fire intensity and high severity including crown fire with mortality. Fuel Model 5 is also high fire severity and fast rates of spread. FM10 and 5 are difficult to contain because:

- flame lengths exceed the safety of hand tooled firefighters (flame lengths over 4 feet in height require mechanized equipment, air resources, or indirect);
- rates of spread over 6 chains/hour (1 chain = 66 feet) and this exceeds the ability of a 20 person crew.

Larger fuels, > 9" diameter, are not often considered the carrier of fire. Large 1000 hour fuel will create longer lasting intensity, higher flame lengths and enable crown and high severity fires to progress. Standard fire suppression operations would require mechanized suppression resources when flame lengths reach heights over four feet. Firefighters are not able to safely suppress fires directly if the flame lengths exceed four feet.

VII.A.6. Existing Condition - Open Oak Savanna

Oregon white oak *(Quercus garryana)* is located above Highway 126 on the south facing slopes. The area is identified as a unique and rare habitat in Management Area 9d and resembles the characteristics of Fire Regime I. A series of aerial photographs dating back to 1936 show conifer trees encroaching into the open oak savannah over the past 70 years. The encroachment of conifers and the loss of open oak dominated hillside may be due to the lack of disturbance.

VII.A.7. Exisiting Condition - Wildland Urban Interface (WUI)

The Bridge Thin Project Area surrounds private land along the McKenzie River, the town of Blue River, the development of Rainbow, and several groups of homes and structures. These areas are considered Wildland Urban Interface (WUI) which is defined as a vicinity of 1.5 miles around structures (USDA 2001). These communities are in Lane County and are part of the Lane County CWPP. This CWPP was developed by communities in Lane County and Oregon Natural Hazards Workgroup in 2005 and adopted by the Lane County Board of Commissioners. The implementation of this plan has not begun in all communities in Lane County but should be in the near future (http://www.co.lane.or.us/Planning/CWPPtoc.htm). Many of the cabins leased from the Forest Service do not have defensible space as specified in *Living with Fire* or the Firewise website (www.firewise.org). Private homes have not been evaluated by Forest Service employees but appear to have the same issues as the Forest Service leased cabins.

VII.B. Proposed Actions - Fire and Fuels

The proposed fire/fuels treatments for Alternative B and C are shown on Table F2 below. The treatments are based on the type of stand, age and size of trees, topography, and location. These factors create the parameters to implement the treatment.

- UB – Underburn
    - Post harvest fuels on the ground will be underburned. Treatment will be done in spring-like conditions when 1000 hour fuels and duff are still

moist, mortality of residual trees will be ≤10% because majority of the trees will be >15” DBH. Hazardous fuels will be reduced to S&G levels. Mop-up follows directly after the unit is ignited.

- UB* - Underburn *
  - Following the harvest the stand will be evaluated again to measure the residual tree DBH. If the majority of trees are 14” DBH they will be more resistant to a light/moderate underburn and the mortality of ≤10% can be maintained. If a unit has the majority of trees 12” DBH mortality in an underburn may be difficult to hold at 10% or less due to the thin bark of the smaller trees. The treatments below will be the alternative.
- Natural Fuels UB – Unit 100
  - No commercial harvest but fuels will be treated through an underburn with mortality at 20%. Given the close location of houses the first treatment may be to do a fuels thin as stated below. Prescription parameters, especially weather will help to decide the NF UB or the FT. Hazardous fuels will be reduced to S&G. Mop up will follow directly after ignition.
- GP – Grapple pile
  - With in units, cover and burn the piles in the winter, and reduce hazardous fuels to S&G.
- HP – Hand pile
  - Within the unit or along the road to reinforce the road as a fire break, cover and burn piles in winter, and reduce hazardous fuels to S&G.
- FT –Fuels thins
  - Reduce standing vegetation <7” DBH. The fuels will be either hand or machine cut then hand piled, grapple piled or chipped/mulched depending on cost or location. The treatment of chipping/mulching will not remove the fuel from the site, but it will change the fuel loading to a more compact profile. No commercial harvesting in these units
- WT – Wildlife Thin broadcast burning
  - One to three acre gaps will be created during the timber harvest. Units 40, 42, and 68 will be underburned, and gaps will be burned at the same time. Units 43, 44, and 45 the fuels treatment may be an underburn, if the DBH does not allow then only the gaps will be broadcast burned within the unit in order to stay within the mortality guidelines for fuels treatments.

Table F2 shows the fuels treatment, fuel loading following timber harvest, and the harvest treatment proposed for each unit and alternative.

Table F2: Fuels treatment and fuel loading post harvest

Unit	Acres	Treatment Alt. B and C	Fuel Loading in tons/acre	Harvest
1	14	**HP**	24	HT
2	140	**GP/HP**	19.1	HT
3	47	**GP**	20.8	HT
4	57	**GP/HP**	17.3	HT
5	73	**UB*/GP/HP**	19.9	HT
6	87	**UB*/GP/HP**	20.8	HT
8	60	**GP**	18.1	HT
10	37	**UB**	17.2	HT
11	37	**HP**	17	HT
12	21	**HP**	18.8	HT
13	21	**HP**	18.8	HT
14	27	**HP**	23.4	HT
15	79	**HP**	21.3	HT
17	24	**HP**	18.4	HT
18	27	**HP**	17.8	HT
20	66	**UB**	22.1	MT
21	12	**GP**	17.1	MT

23	12	**GP**	21.1	MT
24	5	**GP**	16.8	MT
25	26	**HP**	23.9	HT
26	14	**UB**	19.8	MT
27	5	**UB**	26.4	HT
28	7	**GP/HP**	33.3	HT
29	47	**UB*/GP/HP**	19.5	HT
30	38	**GP/HP**	23.8	HT
31	19	**UB*/HP**	18.5	HT
32	123	**UB**	20.2	MT
34	5	**UB**	20.1	MT
35	54	**GP/HP**	24.6	HT
36	36	**HP**	23.3	HT
37	43	**HP**	19.8	HT
38	27	**UB**	18.5	HT
39	20	**UB*/HP**	20.9	HT
40	27	**UB**	20.8	WT
42	32	**UB**	12.9	WT
43	44	**UB*/GP/HP**	22.7	WT
44	45	**GP**	22.9	WT
45	38	**GP/HP**	19.2	WT
46	41	**UB*/GP/HP**	14.1	HT
47	32	**HP**	31.7	HT
48	17	**GP**	22	HT
49	7	**GP**	27.3	HT
50	6	**FT**	16.3	FT
51	20	**HP**	30.8	HT
52	11	**UB*/HP**	30.8	HT
53	3	**UB**	13.8	HT
54	10	**GP**	35.3	HT
55	25	**UB*/HP**	23.9	HT
56	43	**UB**	29.2	HT
57	15	**UB**	25.5	HT
58	16	**UB*/HP**	17.5	MT
59	22	**UB**	40.2	HT
60	24	**UB**	17.6	MT
61	16	**UB*/GP**	24.1	HT
62	19	**UB**	17.4	MT
63	29	**HP**	23	HT

64	42	**GP/HP**	21.8	MT
65	10	**HP**	22.5	MT
66	11	**UB**	20.8	MT
67	22	**UB**	20.7	MT
68	41	**UB**	17.3	WT
69	33	**UB*/GP/HP**	21.7	HT
70	3	**UB**	15.7	MT
72	28	**UB**	13.2	HT
80	*10*	***UB – B***	*24.3*	*WT*
81	*14*	***UB – B***	*21.4*	*MT*
82	*35*	***UB – B***	*21*	*HT*
83	17	**UB**	40.7	HT
84	32	**UB oak**	20.4change	OT
841	26	**UB**	20.9	HT
85	12	**UB oak**	10.5	OT
86	7	**UB with oak unit**		OT
87	2	**UB with 88 or 83**		OT
88	*36*	***UB – B***	*21.9*	*HT*
89	6	**FT**	Change	FT
91	*38*	***UB – B***	*14*	*HT*
95	27	**FT**	25change	FT
96	10	**FT**	26.7change	FT
97	5	**FT**	17change	FT
98	4	**FT**	16change	FT
99	13	**FT**	19.9change	FT
100	42	**Natural Fuels UB**	18.8change	FT
101	12	**FT**	17.8change	FT
102	33	**FT**	20.9change	FT
103	26	**FT**	??	FT

HT – heavy thin; MT – moderate thin; WT – wildlife thin; OT – oak thin; FT – fuels thin
Age of Units #1-72 are 80 years or less;
Age of Units #80-103 are 100 years or more
Units in *italics* are for Alt. B only.

VII.C. Environmental Consequences

VII.C.1. Effects of Alternative A – No Action

1.a. Direct, Indirect and Cumulative

In the Bridge Thin Project Area the No Action Alternative would not support returning fire as a natural disturbance process to the ecosystem due to fire suppression responsibilities and life, structure, and resource priorities. Through time, fuel loading would continue to increase and vegetation would continue through successional pathways. Stands would continue to grow increasing fuel loading on the ground and canopy closure thus escalating the potential wildfire behavior. Areas near private residences would not have any reduction in fuels to aid in reducing wildfire intensity and mitigating hazards for firefighters. In the absence of prescribed fire and treatments, ladder fuels and canopy closure would be high, thus providing propellants for severe, high intensity wildfires. FRCC would not be maintained at a FRCC1, again reducing the natural forest resiliency to disturbance. No Action would not create the DFC, reduce firefighting risks, or be cost effective due to suppression of high severity fires.

VII.C.2. Effects Common to Alternatives B and C
2.a Direct and Indirect Effects

Harvests increase fuel loading in a unit which increases the wildfire behavior potential. Following the harvest a greater hazardous fuels condition exists for 0-5 years because of the red needle slash. This slash has high ignition and spread potential. This would be reduced with the fuels treatment 1-2 years post harvest. Across the landscape the lack of variability in the horizontal and vertical fuel profile also increases the spread potential and intensity of wildfire. The proposed fire and fuels Actions in Alternative B and C would change the fire and fuels environment by:

- returning the historical disturbance process of fire with prescribed fire treatments;
- reducing hazardous fuels to levels of S&G and create variability in the horizontal and vertical profile;
- creating a mosaic and distribution of seral stages present in a mixed severity fire regime taking steps towards change from FRCC2 → FRCC1;
- increasing fire tolerant conifers and reducing shade tolerant conifers;
- creating safe and cost effective protection of life, structures, and resources through reducing the risk of potential high severity fires.

All prescribed fire treatments would create variability across the landscape and return a vital disturbance process to the ecosystem. The distribution of seral stages that determine the FRCC would not completely change the Bridge Thin Project Area from a FRCC2 to a FRCC1. However, the treatments would begin the steps towards reaching the FRCC1. Future treatments would need to take place in order to reach that goal and create the early, mid, and late seral stage distribution that is needed under a FRCC1.

The proposed action timber harvests will create varying amounts of timber slash in each unit (see Table F2). The increased fine fuel loading may reduce the success of initial attack suppression operations due to the fast rate of spread and the flame lengths at >4 feet. Activity fuels (slash) treatments would reduce the amount of fuel created from the harvests to the S&G fuel loading of 7-11 tons/acre for 0-3" diameter fuel. Fuels treatments are proposed to be within 1-2 years after the harvest. The reduction in fuel loading would reduce the potential wildfire behavior.

Table F3 displays the changes in fire behavior within the unit of treatment for existing, post harvest, and post fuels treatment conditions. Fire behavior that exceeds 4 foot flame lengths require machinery or aerial support to reduce the risks to tooled firefighters.

Table F3: Existing fire behavior

	Rate of spread (chains/hour)	Flame length (feet)	Crown fire with % mortality	Spotting potential (miles)
FM5	117 ch/hr	13 feet	Active 99% mort	Yes at 0.6 miles
FM10	38 ch/hr	11 feet	Active 37% mort	Yes at 1.5 miles
FM12	37 ch/hr	13 feet	Active 97% mort	Yes at 0.6 miles
Post Fuels Treatment	5 ch/hr	2 feet	Active 12% mort	Yes at 0.6 miles

- Crown fire activity is displayed as *Active*, which means that fire is present in both the surface fuels and canopy fuels.

- Post fuels treatment examines the fire behavior as FM8 because units will have lower fuel loading, higher CBH, and varying canopy density.

In all the units where fuels treatments take place S&G would be met.

- reducing fuel loading of 7-11 tons/acre for 0-3” diameter fuel;
- maintaining duff coverage of 85% or more;
- weight of equipment and machinery would be with in range;
- downed woody debri minimum of 240 linear feet of 20” DBH;
- IDT decision to keep mortality at 10% or less.

Underburns in Units 84, 85, 86, and 87 aim to restore the unique and rare habitat of the open oak savanna. The DFC would be to burn every 5-15 years in order to reduce the conifer encroachment and maintain oak as the dominant species (Regan and Agee 1996). With the lack of disturbance the faster growing conifers would progress faster than the oak. The fire regime in the oak habitat, on the south facing slope, shows as a Fire Regime I. Returning the disturbance of fire and reducing the conifers would invigorate the oaks to maintain their habitat.

Fuels thins would occur in Units 50 adjacent to the private property, 95-99 are located between Highway 126 and McKenzie River Drive, and Unit 101, 102, and 103 are north and south off of King Road; all are in WUI. These units are directly next to houses. Potential wildfire behavior would be reduced due to decrease surface fuel loading, increase in CBH through the reduction of ladder fuels, and variability in vegetation continuity post treatment. The treatment of chipping/mulching would not remove the fuel from the site, but it would change the fuel loading to a more compact profile, condensing the lofty fuels where rates of spread would be less. These changes create part of the defensible space next to the private land and along the highway where human caused fire, such as burning rubbish thrown from cars, can ignite wildfires. Following the treatments the fuel profile would aid in protecting the private property if a wildfire were to approach the area and reduce the risks to firefighters.

The proposed treatment of Unit 100 would be a natural fuels underburn. This unit is also along King Road next to private land. A natural fuels underburn would provide a reduction in the hazardous fuels, decrease the movement of wildfire from the ground to the canopy by reducing the ladder fuels, and creating variability in the canopy density. Mortality in these stands would be around 20% or less. Recreation mitigations will be taken to close the trail during the burn and also initiate light severity ignitions along the trail. The UB would be completed on the east side of the trail. With the UB the fire behavior would change from FM10 to a FM8 in wildfire conditions. Underburning is a preferred method of treatment not only to reduce hazardous fuels but to return fire to the ecosystem.

Treatments in units located near private residences aim to protect and improve the defensible space in the WUI. The proposed treatments would occur on 176 acres and reduce the spread of a wildfire near the homes through the reduction of ground and ladder fuels. This profile decreases the potential for ground fire to carry into the canopies and produce embers that can land on roofs which is one of the main ignition sources in the

WUI. Life, private property/structures, and resources are the highest priority to protect during wildfire suppression.

Treatments to create more defensible WUI would ultimately be a collaborative effort of public and private land owners. A reduction or change of vegetation next to homes (defensible space) or in vegetated pathways that lead to developments or structures (WUI) is important to aid State and Federal firefighters in suppression activities. Life and private property are the highest priority to protect during wildfire suppression. The locations of Bridge Thin treatments coincide with the interface and would help to begin the process.

Underburns would take place during the spring or during spring-like conditions where the soil and duff moisture are damp and fuel moisture in the large woody debris is high. These conditions slow or stop consumption which helps to retain sustainable levels of duff, soil coverage, and large woody debris often used by wildlife. Additionally, mortality of residual overstory trees can be controlled more specifically because of high live fuel moistures.

Underburns or wildlife broadcast burns may require handlines constructed around the perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Handlines are created by scraping fuel back to an 18” mineral soil line and scattering fuels that lie within 10 feet of the proposed line. If units are located on a steep slope waterbars are created within the fireline to reduce erosion.

Hand, grapple, and landing piles are covered with regulatory plastic following construction. This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall or early winter when there is very low risk of the piles spreading into other fuels. Removing the plastic before burning is suggested in order to aid in reducing emissions from the plastic.

VII.C.2.*b Effects Unique to Alternative B*

Units 80, 81, 82, 83, 88, and 91 are proposed to be underburned post harvest. These units are located above Highway 126 and are within WUI. The fuels and variability in the horizontal and vertical profiles would change, thus reducing the potential severity of wildfire behavior. Being in the WUI this would also reduce the risks and hazards during fire suppression.

VII.C.2.*c Cumulative Effects Common to Alternatives B and C*

Cumulative effects are based on management activities that have or would occur in the Bridge Thin Project Area. The area analyzed displays the direct and indirect effects of fire on the treated units which translate to the variation of fuel profiles over the larger disturbance landscape. Proposed fuel treatments, in concert with harvest activities, would help to diversify the fuel profile across the landscape. Future wildfire suppression actions will continue, however the proposed treatments aid in returning the natural disturbance to the landscape. No other foreseeable future fuels management activities are planned within the Bridge Thin Project Area that would contribute incrementally to the cumulative effects from past or currently proposed activities.No adverse effects on the fuel profile or on fire behavior would result from the proposed fuel treatments.

VII.C.2.*d Conclusion to Effects of Alternative B and C*
Alternatives B and C fuels treatments would be conducted following S&G. Hazardous fuels would be reduced to meet the DFC. FRCC 2 would move closer to FRCC 1. WUI units would aid in creating safer conditions for firefighters and home owners. And all the treatments would reintroduce the disturbance process of fire to the ecosystem.

VII.*D.1. Existing Condition – Air Quality*
The State of Oregon has been delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To regulate these standards, the state developed the Oregon Smoke Management Plan and the State Implementation Plan. These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission control in Oregon (LRMP, 1990).

Designated Areas and Class I Airsheds are priority areas regulated in order to protect air quality. The Willamette Valley (at the eastern side, Leaburg) and Oakridge are the closest Designated Areas to Bridge Thin Project Area (15 and 35 miles respectively). Three Sisters Wilderness and Mt. Washington Wilderness are the closest Class I Airsheds to the Bridge Thin Project Area (3 and 11 miles respectively). Class I Airsheds must be protected from visibility impairment July 1 through September 15.

VII.D.2 *Environmental Consequences – Air Quality*
2.a Direct, Indirect and Cumulative Effects of Alternative A – No Action
If no management actions take place in the Bridge Thin Project Area no air quality impacts would occur in a scheduled timeframe. However, the risk of wildfire would still exist. In the event of a wildfire, air quality impacts are considerably higher than prescribed fire. Smoke emissions are not short term and can often last for many weeks or months, as witnessed during the Puzzle and GW Fires in 2006 and 2007, respectively. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of PM 2.5 and PM 10. Table F3 displays emissions are considerably higher than prescribed fire emissions, posing risk to community residents, forest users, and firefighters. Acreage used for the above wildfire calculation was 2502 acres, the number of harvest and treated acres in Alternative B.

VII.D.2.*b Effects Common to Alternative B and C*
Prescribed fire of activity fuels in the Bridge Thin Project Area would comply with Oregon Smoke Management Plan regulations. Smoke emissions would be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. Regulations enforce specific days which are suitable to burn in relation to other land owners burning or weather forecasts. Prescribed fire would most likely be avoided between July 1 and September 15 in order to protect visibility standards for Class I Airsheds.

Recreationists and some local residents near Bridge Thin Project Area may be temporarily impacted by smoke from the prescribed fire underburns or pile burning. In the Oregon Smoke Management Plan, non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon SMP 1995). Mitigation measures, such as signing along the road or near the treatment area, would be taken in order to reduce the amount of nuisance smoke and notifications to the public would be made prior to burning.

Smoke emissions were predicted using the estimates from the debris prediction tables and FOFEM (First Order Fire Effects Model version 5.0). This model calculates particulate matter emitted based on the amount of fuel consumed. Fuel inputs were from the predicted post harvest data and based on a percentage of fuels that would most likely be consumed given the prescribed fire window. That is, weather and fuels dryness would be measured to achieve the objective of reducing the fuel profile across the unit. From past experience, fuels treatments consume an average of 80% of the fine fuels (0-1 inch diameter), 60% of the 1-3 inch fuels and only about 20% of the 3-9 inch. LWD >9 inches is most often too wet to be consumed. FOFEM however consumes 100% of 1, 10, and 100 hour fuels in spring-like conditions. Table F3 summarizes particulate matter predicted for fuels treatment activities. Alternative C is not shown because it is less than Alternative B.

Table F3: Summary of particulate matter emissions for Bridge Thin Project Area for all treatments

	Alternative A – Wildfire	Alternative B	Alternative C
PM 2.5 total	1735 tons/acre	517 tons	484 Tons
PM 10 total	2048 tons/acre	610 tons	572 Tons

It is important to note these emissions levels do not occur at one time. Usually prescribed fire operations occur one unit at a time (in one day). For example, Unit 80 is predicted to have 24.3 tons/acre of 0-3” diameter fuel post-harvest. During the prescribed fire underburn, emissions are estimated at 2.37 tons/unit of PM 10 and 2 tons/unit of PM2.5.

VII.D.2.*c Cumulative Effects of Alternative B and C*

No adverse effects on the air quality would result from the proposed fuel treatments. The area defined for cumulative effects is the Bridge Thin Project Area where the treatments occur as well as the larger landscape where smoke emissions can travel. These are the locations of the Designated Areas and Class I Airsheds. Neither would be affected from the treatments. Smoke emissions would be short duration and mitigation measures would reduce the quantity of emissions during prescribed burns. Past management activities do not cumulatively add to air quality impacts from the proposed treatments. Proposed maintenance burns of Unit 80 should produce less smoke emission than before due to the quick prescribed fire return interval. No other foreseeable management activities that would affect air quality are scheduled to occur in the Bridge Thin Project Area.

VII.D.2.*d Conclusion of Effects of Alternative B and C*

Mitigation measures to reduce quantity of smoke emissions from burns would be to burn in spring-like conditions (as stated in the fuels treatment section) with LWD about 30% fuel moisture and damp duff. All these would meet the S&G and Air Quality Regulations.

VIII. Cost of Project Treatments

The expected loss table developed for the McKenzie River RD in 2007 was used in this analysis from the Fire Management Area Zone – Central Zone, non-wilderness. Treatment costs were established as follows:

- Underburning - $850/acre (this includes prep, burning, and mop-up)
- Hand piling - $900/acre (this includes construction, covering and burning)
- Grapple piling - $600/acre (this includes construction, covering and burning)
- Chipping - $400-1600/acre

Many complex objectives on each unit increase planning, preparation, and implementation time, thereby increasing the cost per acre. All treatment costs are less than the expected loss of resources and/or structures to wildland fire. Returning fire back into the ecosystem through the proposed actions would meet objectives defined in the Purpose and Need. Fuels treatments are selected on effectiveness at meeting resource objectiveness.

Table F4 below estimates the costs on the high end by Alternative. The UB acres are for the maximum number of acres that could be underburned. The resultant DBH in each unit post harvest would determine if the unit is UB or piled. The units proposed to have fuels thins are calculated in the chipping treatment. Some units would received both grapple piling and hand piling treatments depending on topography. The costs below are calculated for grapple piling on those units.

Table F4: Estimated Treatment Costs By Alternatives

		ACRES			**COST**		
Treatment	**Cost/ac**	**A**	**B**	**C**	**A**	**B**	**C**
UB	850	0	1488	1355	$0	$1,264,800	$1,151,750
Hand Pile/burn	900	0	455	455	$0	$409,500	$409,500
Grapple Pile/burn	600	0	403	403	$0	$241,800	$241,800
Chipping	1000	0	140	140	$0	$140,000	$140,000
Total Est. Costs					**$0**	**$2,056,100**	**$1,943,050**

IX. Monitoring

Fuels treatments would be monitored prior to treatments and also post treatments. Fuel loading would be evaluated, documented, and used in models to compose burn plans and also learn from treatments. Digital photos should be taken pre and post treatment in order to have a visible image of the changes that occur on the unit.

Attachment F1

Terminology

- Broadcast burn – prescribed fire
- Crown Base Height – the lowest canopy branches to the ground
- Fuel Loading refers to the amount of fuel present in terms of weight per unit area. Fuels are expressed by size and hours required to dry.
    - 0” – .24” or 1 hour fuels
    - .25” – .99” or 10 hour fuels
    - 1.0” – 2.99” or 100 hour fuels
    - ⩾3.0” or 1000 hour fuels
- Fuel Models quantify surface fuel loading (amount of fuel in tons/acre), arrangement, structure, and calculate predicted fire behavior. The primary fuel that carries the fire is the general classification key for fuel models, i.e. grass, timber litter, brush or timber slash.

- Handline – NFP glossary

- Hazardous Fuels –

- Ladder Fuels -

- New Fuel Models – 40 dynamic

- LANDFIRE –
- Fire Regime – describes the historic role of fire on the landscape. Fire regimes for Oregon and Washington are from the 1999 National Fire Strategy and are redefined for Region 6 based on common severity type, and the frequency of that expression on the landscape.

Fire regime group for R6	Frequency (Fire return interval)	Severity
I	0-35 years	Low severity (underburn)
II	0-35 years	High severity (stand-replacing)
III A	< 50 years	Mixed severity
III B	50-100 years	Mixed severity
III C	100-200 years	Mixed severity
IV A	35-100 years	High severity (stand-replacement), juxtaposed
IV B	100+ years	High severity (stand-replacing), patchy arrangement
IV C	100-200 years	High severity (stand-replacement)
V. A	200-400 years	High severity (stand-replacing)
V B	400+ years	High severity (stand-replacing)
V C	No Fire	
V D	Non-forest	

- Fire Regime Condition Class (FRCC) describes the degree of departure of current vegetation from the historic fire regime (Hann, et.al. 2003). FRCC 1, 2, and 3 ranks the degree of departure with the following:

- FRCC 1
    - Fire regimes near historic range (departure is no more than one return interval)
    - A low risk of losing key ecosystem components
    - Vegetation attributes are functioning within historical range
- FRCC 2
    - Fire regimes have been moderately altered from historical range; moderate changes in fire size and intensity has resulted
    - Moderate risk of losing key ecosystem components
    - Vegetation attributes have been moderately altered
- FRCC 3
    - Fire regimes have been significantly altered from their historical range; dramatic changes in fire size and severity has resulted
    - Severe loss of ecosystem components
    - Vegetation attributes have been significantly altered

- FRCC is mapped and calculated using three steps:
    - determination of vegetation-fuel condition class
    - determination of fire frequency/severity condition class
    - determination of stratum fire regime condition class

Attachment F2

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Heritage Resources
Specialist Report

Bridge Thin Timber Sale Project

Willamette National Forest
McKenzie River Ranger District

Lane County, Oregon

/s/ Cara M. Kelly
Cara M. Kelly
Archaeologist
December 19, 2007

HERITAGE RESOURCES

Bridge Thin Project EA
Willamette National Forest
McKenzie River Ranger District
December 19, 2007

Introduction

The purpose of this report is to analyze the effects of Timber Sale Harvest activities proposed under the Bridge Thin Project Environmental Analysis (EA) on cultural resources. Heritage resources are fragile and irreplaceable resource that chronicles the history of people utilizing the forested environment.

Regulatory Framework

The legal framework that mandates the Forest Service to consider the effects of its actions on heritage resources is wide-ranging. In this case, Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation governing the treatment of cultural resources during project planning and implementation.

Implementing regulations that clarify and expand upon the NHPA include 36 CFR800 (Protection of Historic Properties), 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and 36 CFR 296 (Protection of Archaeological Resources), the 1994 Programmatic Agreement (PA) (amended in 2004) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service.

The National Environmental Policy Act is also a cultural resource management directive, as it calls for agencies to analyze the effects of their actions on social-cultural elements of the environment. Laws such as the National Forest Management Act (NFMA) of 1976, the Archaeological Resources Protection Act (ARPA) of 1979, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, and Executive Order 13007 (Indian Sacred Sites) also guide the Forest Service decision making as it relates to heritage resources.

The Willamette National Forest Land and Resource Management Plan tiers to the previously mentioned laws and corresponding Forest Service manual direction as it sets forth standards and guidelines that specify procedures for complying with all mandates for Federal Laws, acts, executive orders, and Federal regulations. Forest-wide management standards that are pertinent for this heritage resource effects analysis include:

- A cultural resource inventory shall be conducted for each proposed ground-disturbing activity and administered by a qualified archaeologist. The results of the inventory will be documented in a report which will serve as a planning document.
- The Forest's survey design strategy for cultural resource inventories shall be used to guide the inventory.
- Properties that may be affected by project activities will be evaluated using the criteria for eligibility to the National Register of Historic Places.
- Measures shall be developed to protect significant sites from adverse effects due to ground disturbing and other activities.

Analysis Methods

The field methods were developed in accordance with the guidelines set forth by the Oregon State Historic Preservation Office and the Willamette National Forest Inventory Plan. Two objectives were considered in creating the survey. First it must cover the possible discovery of the various site types known to occur within the project area; and second it must cover heritage properties known or believed to exist within the project area for purposes of monitoring their conditions or verifying their location. Utilization of information from prior surveys and the identification of known site locations were incorporated into the research design.

Along with the above objectives three requirements were incorporated into the overall survey design:

- One hundred percent high probability ground and 20 percent low probability must be covered unless it has been covered by a recent inventory survey, which meets current standards, given that no change in surface visibility has occurred since the time of the survey. Low probability ground over 65 percent should be considered but does not necessarily need to be surveyed.
- The effect on heritage resources, both discovered and undiscovered, expected to occur during the course of the proposed Bridge Thin Timber Sale harvest shall be determined.
- All heritage resources will be avoided when they are found to be in conflict with the proposed timber harvest units and associated roads and landings. Determination of property avoidance will be made after all the fieldwork is completed.

Description of Field Surveys

The archaeological survey of the Bridge Thin Timber Sale was conducted in order to comply with the above stated laws and regulations (see regulatory framework). A systematic surface pedestrian search is the principal manner for implementing the mandated goals.

Ground surveys for the proposed Bridge Thin timber sale occurred between June 18 and August 8, 2007. Surveys were conducted under contract by Warm Springs Geo Visions Cultural Resources Department for the Willamette National Forest (Gauthier et al. 2007). Pedestrian transects with 15 to 20 meter spaced intervals followed a specific orientation based on factors that included the shapes of units and landforms and the possible presence of historic Indian or Euro-American travel routes. One-by-one meter shovel scrapes made with entrenching tools exposed mineral soil every 20 to 30 meters in areas where dense vegetation limited ground visibility. Bearing orientations were followed to the best of abilities, but adjustments in orientation, spacing intervals, and shovel scrape spacing were made in order to avoid dangerous or unreasonable conditions (e.g., exceptionally steep slopes or impenetrable vegetation). The surveyor's utilized Garmin Etrex Summit™ Global Positioning System units to record transect routes for accuracy of coverage and compass and tape techniques were also utilized (Gauthier et al. 2007). A total of 1292 acres were survey consisting of 949 high probability and 343 low probability acres.

Existing Condition

The prehistory and history of the McKenzie River drainage have previously been summarized in Cultural Resource Overview for the Willamette National Forest, Western Oregon (Minor and Pecor 1977), the ten-year update of the above overview (Minor 1987), Prehistory and History of B. L. M. Lands in West-Central Oregon: A Cultural Resource Overview (Beckham, Minor, and Toepel 1981), Archaeology of Oregon (2nd Edition) (Aikens 1986) and numerous other publications. These documents provide adequate detail of ethnographic and historic background for this report.

Prehistoric Use

Ethnographic research indicates that highly mobile prehistoric and early historic aboriginal groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purpose of seasonal hunting, fishing, and plant gathering. Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be a montane-based band that were living in the western Oregon Cascades during the historic period. The Molala generally are known to be split into two subgroups: the Northern Molala located in the vicinity of Mount Hood's drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of a third group, referred to as the Upper Santiam/Santiam band of Molala known to have occupied Linn and Lane counties in areas between the Northern and Southern groups. The Molala are also often culturally grouped with the Kalapuya who were based in the Willamette Valley but probably made seasonal forays to the Cascades for large game and berries. Many of the Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molalla Treaties of 1855). Other Molala shifted to the Siletz Reservation along the Oregon coast, the

Klamath reservation to the south and east into Central Oregon where they were absorbed into the Confederated Tribes of Warm Springs Reservation of Oregon.

Prehistoric resources left behind by the Indians include chipped obsidian lithic scatters and obsidian lithic isolates, representing tool use, modification, or manufacture related to hunting and gathering. Ongoing stone tool analysis, both by agency archaeologists and contractors, supports that this portion of the Cascades was occupied primarily by highly mobile people indigenous to the Cascades. Those people were probably ancestral to the Molala people that were involved in early but unratified treaties of the 1850s.

Culturally significant vegetation observed within the timber sale units includes abundant sword, wood and bracken ferns, Hazelnut (Corylus cornuta), oceanspray (Holodiscus discolor), western red cedar, salal, Oregon grape, trailing or Pacific blackberry (Rubus ursinus), huckleberry, wild strawberries (Fragariw vesca, F. verginiana), raspberries (rubus idaeus, R.leucodermis), and thimbleberry (R. parviflorus), bitter cherry (Prunus emarginata), wild ginger (Asarum caudatum), alder (alnus crispa sp) (Gauthier et al. 2007). All of these food resources are still commonly used by present day Indian Tribes.

Historic Use

Historic accounts document the presence of horse-mounted Warm Springs Indians traveling into and through the area in the late 1800s and early 1900s (Williams 1988); these seasonal travels were motivated by the need for forage for horses, huckleberry gathering, inter-tribal contacts and visiting, hunting, fishing, trading with white settlers, and travel to seasonal cash employment, such as picking hops in the Willamette Valley (Williams 1988; Bergland 1992).

The earliest recorded permanent Euro American settler in the area was John Templeton Craig, who homesteaded at Craig's Pasture (now McKenzie Bridge) in the 1860s. The prospect of a toll road over the McKenzie Pass began to draw settlers into the area after 900 cattle and nine wagons made it over the pass on a rough track (the Scott Wagon Road) in the fall of 1862 (Williams 1988).

The town of Blue River was founded in 1886 (Williams 1988). Subsistence hunting, farming, and stock raising were the primary lifestyles of the early settlers. A greater influx of people into the area was encouraged by the passage of the Forest Homestead Act in 1906, which allowed homesteaders to claim land set aside as national forest. The first sawmill in the region was opened on the lower McKenzie in 1851 however systematic logging of huge tracts of forest did not occur until the 1890s.

Historic Administrative use appears in the form of trails and early logging activity. The Santiam NF Maps (1913, 1931) and the Cascade National Forest 1925 map depict several historic or prehistoric trails crossing through the project area. These include the Castle Rock Trails and trails to Deathball Rock and Thors Hammer. Several historic structures clustering around the Blue River, McKenzie Bridge, and Rainbow areas are visible on Forest Service maps dating back to the 1920s. A historic ranger station at McKenzie Bridge, along with the Paradise and Blue River Guard stations, is also noted on Forest

Service maps between 1913 and 1931. The Belknap CCC camp was located at the present site of the McKenzie River Ranger Station (Gauthier et. Al 2007).

Environmental Consequences

The site types recorded within the Bridge project area include lithic scatters and historic logging debris. The archeological sites within the project area are considered potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine their eligibility to the NRHP. The proposed Bridge Timber Sale has the potential to affect two of the known cultural sites (06180100583 and 06180100284) within or near the project area. To protect these potentially eligible sites the project was redesigned by dropping portions of timber sale stands.

Direct and Indirect Effects
Alternative 1(No Action)
Implementation of the no action alternative would not directly nor indirectly affect cultural resources since there would be no change to the integrity of heritage resource sites.
Implementation of Alternatives 2 and 3 would not directly nor indirectly affect cultural resources. The potentially eligible sites have been protected from Timber Harvest by redesigning the timber sale unit boundaries and associated project activities.

Cumulative Effects
Past, Present, and Foreseeable for All Alternatives
It is not anticipated that there would be cumulative effects to the potentially eligible cultural resource sites in the Bridge Thin Timber Sale Project Area from any of the proposed actions. The following mitigation measures cover the maximum alternative and are designed to minimize any effects this project might have on heritage resources.

Mitigation Measures

The proposed mitigation measures for the Bridge Thin Timber Sale Timber Sale are listed below and cover all alternatives. They are based on the results of the field inventory and information gleaned from the District's cultural resource files.
Information specific to heritage resource location and content is exempt from disclosure under the Freedom Information act (FSM 6271.2). In order to facilitate the decision-maker, the information will be made available to him.

1) All NRHP eligible sites and potentially eligible sites must be avoided during all project activities.

2) Changes to the current unit configurations and/or the addition of any new units, will require consultation with the District Archaeologist in order to protect known and unknown heritage resources.

3) Project activities planned outside of the area defined in the heritage resource inventory schema must be coordinated with the district archaeologist prior to initiation. This

includes the establishment of new harvest landings, helicopter landings, guy-line equipment anchors, slash burning, removal of roadside danger trees, ripping or cultivating temp spurs roads.

4) Although no other surface or subsurface evidence of cultural resources was found in the proposed project, there remains the possibility that buried prehistoric or historic cultural resources are present and could be uncovered during project activities. If cultural resources are encountered during the course of this project, earth-disturbing activities in the vicinity of the find should be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event heritage resources are discovered during timber sale operations.

Consistency with Direction and Regulations

State Historic Preservation Officer consultation has been completed under the terms of the 1995 Programmatic Agreement (amended 2004).

Irreversible/Irretrievable Commitments

"Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource use. The heritage Resource Mitigation measures listed above and the Forest Plan Standards and Guidelines are designed to avoid or minimize the potential for irreversible losses from the proposed management actions. There are no irreversible and irretrievable commitments that would affect heritage resource by implementing any of the proposed alternatives.

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1913, 1931 Santiam National Forest Map
1937 and 1947 Willamette National Forest Maps

Appendix H – Response to Scoping Comments

On (May 18, 2007), the Responsible Official mailed a scoping letter to other agencies, tribal organizations, and interested public listed in Chapter 4.

The Interdisciplinary Team has responded to the following comments received during scoping:

Submitter	Comment	Response and Where Addressed in the EA
Michael Karnosh, Ceded Lands Coordinator, Confederated Tribes of Grand Ronde, Grand Ronde Oregon	Potential Impacts to Cultural and Archaeological Resources is not currently listed as a preliminary issue. Since the Project Area is within the Tribe's ceded lands and the proposed project includes ground-disturbing activity, the preliminary issues should include Potential Impacts to Cultural and Archaeological Resources. When analyzing stream crossing structures for fish passage, potential for passage by Pacific lamprey should be evaluated along with passage by other aquatic specie	This issue was not considered significant because Federal laws and regulations require that cultural resources be protected either through avoidance or data recovery. Cultural resource surveys of the proposed project area have been completed. All surveyed and inventoried significant cultural resource sites in the Bridge Thin Project area would be buffered and excluded from resource management activities. Current fish surveys have not documented Pacific Lamprey in the streams affected by crossing structures. Considerations are made for Lamprey with the Western Brook Lamprey being the species documented to date.
Jacob Groves, Western Oregon Field Forester, American Forest Resource Council, Eugene, OR	AFRC would like to see all timber sales be economically viable. Appropriate harvesting systems should be used on all units to achieve an economically viable sale and increase the revenues to the government. AFRC would like to voice support for management activities that enhance big game foraging habitat. From 1991 to 1995, National Council for Air and Stream Improvement Scientists Dr. John G. Cook, Dr. Larry L. Irwin, along with DR. Jack W. Thomas, and others studied the effects of thermal cover on elf.	Economic viability discussed in Chapter 3 with values shown in Table 35. An analysis of big game habitat is found in chapter 3 and acknowledges new science on findings of thermal cover as it relates to the Elk model.

Submitter	Comment	Response and Where Addressed in the EA
	Their findings showed that providing thermal cover for elk was not a suitable solution for inadequate forage conditions and they suggested that habitat management based on the perceived value of thermal cover should be reevaluated. It is important, in light of this new research, that elk habitat adequately incorporates the importance of nutritional needs and does not over emphasize the importance of thermal cover.	
	In addition to restoring “open oak savannah”, AFRC would like to suggest the use of multiple small patch cuts (3-5acres in size) to provide early successional habitat for Roosevelt Elk. Early successional habitat is not provided by typical thinning treatments. Thinning treatments do not provide the quantity or quality of forage that would be sufficient to sustain wild ungulate populations. Northwest Forest Plan states that early successional habitat will be provided for these species on federal lands.	Group selection is the term used to describe small patch opening and are described in Chapters 2 and 3.
	Seasonal and wildlife restrictions often make timber sales extremely difficult to complete within contract timelines. AFRC would also like to encourage the Forest Service to offer sales that will allow winter harvesting on improved roads or allow for roads to be improved so winter harvesting can be accomplished.	Chapter 2, Wildlife Mitigations describes required seasonal restrictions. There are only two restrictions required.
	AFRC also would like to voice support for thinning treatments in the riparian areas of the Bridge Thin Project EA. By prescribing small no cut buffers (25-60 feet) to be left to maintain stream temperatures and thinning the remaining acres inside the riparian reserves you can achieve the management objectives of moving them into late seral habitat faster. By reducing the no cut buffers to 25-60 feet and thinning down to that distance, the forest also harvests more volume during the sake thus reducing unit cost. We encourage the Forest Service to continue to use silvicultural thinning treatments in riparian reserves on future projects to accelerate the development of desired riparian conditions.	Riparian Thinning treatments are addressed in Chapters 2 and 3. Table 7 summarizes riparian reserve management.
Karl Morgenstern, Drinking Water Source Protection	Scope and planned operations associated with development of the Blue River, Mill Creek and Mill Creek Overlook rock quarries. The EA	The Mill Creek rock quarry is the only quarry to be carried forward with this project. Rock volumes

Submitter	Comment	Response and Where Addressed in the EA
Coordinator, Eugene Water & Electric Board	should include adequate discussion of the volume anticipated to be removed from these quarries, how operations will be conducted to minimize runoff during storms and spills/leaks of fuel, oil, hydraulic fluids, etc. from equipment and what the post harvest plans are for these quarries. These types of areas can be magnets for trash dumping and other illicit activity after use of quarries stops.	are less than 15,000 cubic yards as stated in Chapter 2. The quarry is located behind a gate with a year round closure that helps prevent trash dumping and other illicit activities.
	More details about the four waste-areas to better understand how these areas will be setup, used, maintained and closed to minimize storm even runoff, water quality impacts, invasive weed production and reduce attractiveness of these areas as illegal dumping grounds. Provide adequate discussion of how the waste areas will be developed and managed.	Existing waste areas are being used with no new ground disturbance as discussed in Chapter 2.
	Reduce hazardous fuels, improve defensible space along urban interface areas and employ fire treatments as a restorative tool. EWEB fully supports these concepts. Include a discussion about the existing fire risks, how these risks compare to fire risks in the rest of the forest and how the proposed harvests will address these risks. EA should also evaluate if the proposed fuels reduction projects are addressing high fire risk areas where geologic conditions could influence fire behavior and pose a higher risk for post-fire landslides.	The Fire and fuels section in Chapters 2 and 3 discusses hazardous fuels reduction, urban interface, fire regimes, and fuel profiles.
	Provide adequate discussion on the types and frequency of monitoring that will be conducted as part of this project to determine if the project met its stated objectives.	Monitoring is discussed in the monitoring section in Chapter 3.
Chandra LeGue, Healthy Forests Advocate, Western Field Office, Eugene, OR	**Road Management**	
	Please provide a map of the proposed road management associated with this project in the EA.	Roads to be closed and decommissioned are listed in Tables 4 and 7. Figures 7,10, and 12-25 depict proposed haul routes, culvert replacements, and temporary roads to be used for this project.
	Some weed introduction and soil disturbance from logging can be off-set by enhanced understory diversity and increased growth of conifers brought about directly by the canopy reduction. However, extensive road construction or reconstruction will not be justified by a small	A discussion of the effects of harvest treatments on soils and invasive plants can be found in the Soils

Submitter	Comment	Response and Where Addressed in the EA
	restoration thinning effort. And ground based logging that allows heavy equipment off of roads may cause significant soil disturbance that will not be offset by any intended benefits to the vegetation.	and Invasive Plants section in Chapter 3.
	Thinning Concerns and Guidelines	
	<u>Variable density thinning</u> We urge you to use these stands, which will allow them to develop into more complex and resilient forests. This means that thinning should be done in a way that creates ¼ to ½ Acre gaps, dense patches lightly thinned, moderately thinned, and heavily thinned patches in every stand. Please incorporate the principles of VDT into the harvest prescriptions for this project.	Variable density thinning with group selection (small gaps) are discussed in Chapters 1 (pg 17), 2 (pg 69) and 3 (pp 78-83).
	<u>Natural stands</u> We generally ask that the agency avoid commercial timber harvest, roads, and mining in late-seral forests. In this case, the proposed action would enter 420 acres of healthy, naturally-regenerated 100+ year old forests. We do not support this portion of the project proposal.	There are six commercial harvest units that are proposed to be harvested in fire regeneration stands under Alternative B (140 acres) but not in Alternative C.
	<u>Legacy features</u> Treatments should include explicit safeguards for protecting all existing snags and large down logs in the harvest units.	Existing snags >12" dbh are recommended for protection when not a safety concern.
	<u>Riparian Reserves</u> In young stands in Riparian Reserves, we support thinning activities that enhance the development of trees to shade streams and become sources of coarse woody debris, as long as these activities do not result in yarding corridors, roads, or other yarding activities impacting water quality and aquatic habitat.	Riparian Thinning treatments are addressed in Chapters 2 and 3. Table 7 summarizes riparian reserve management.
	<u>General Guidelines for thinning</u> Use the historic range of variability as a guide, but don't just focus on seral stage. Consider also the historic abundance of ecological attributes like large trees, large snags, roadless areas, etc. all of which	

Submitter	Comment	Response and Where Addressed in the EA
	have been severely reduced from historic norms. Treatments in forests with naturally mixed-severity fire regimes should be carefully scrutinized to ensure those areas are really outside of the HRV and treatments are really needed. Treatments in mixed severity fire regimes should be patchier and leave behind more structure, more snags and large dead wood. Prioritize treatment of the dense young stands that are most “plastic” and amenable to restoration. Another priority is to carefully plan and narrowly target treatments to protect specific groves of fire-resistant, old-growth trees that are threatened by ingrowth of small fuels, but don’t focus on rigid density reduction targets. Leave all medium and large trees that show old-growth characteristics. Thin from below, retaining the largest trees or use “free thinning” with a diameter cap so that some trees of all size classes are retained. Retain all large trees and most medium sized trees so they can recruit into larger classes of trees and snags. Regardless of size, retain all trees with old-growth characteristics such as thick bark, flat top, asymmetric crown, broken top, forked top etc. these trees have important habitat value and human values regardless of their size or age. Allow natural processed of succession and mortality turns some of these medium and large trees into ecologically valuable snags and down wood. Don’t thin to uniform spacing. Use variable density thinning techniques to establish a variety of microhabitats, break up fuel continuity, create discontinuities to disrupt the spread of other contagious disturbances such as disease, bugs, weeds, fire, etc. Retain patch clumps of trees which are the natural pattern for many species. Use your creativity to establish diversity and complexity both within and between stands. Use skips and gaps within units to help achieve diversity Thin heavy enough to stimulate development of some patches of understory vegetation, but don’t thin so heavy that future development	A thorough discussion of thinning and the rationale for various proposed silvicultural treatments including variable density thinning can be found in Chapters 2 and 3.

Submitter	Comment	Response and Where Addressed in the EA
	of the understory becomes a more significant fuel problem than the one being addressed by the current project. Retain and protect under-represented species of conifer and non-conifer trees and shrubs. Retain patches of dense young stands as wildlife cover and pools for recruitment of future forests. Retain abundant snags and course wood and green trees for future recruitment of snags and wood. Retain wildlife trees such as hollows, forked tops, broken tops, leaning trees, etc. If using techniques such as whole tree yarding with tops attached to control fuels, the agency should top a portion of the trees and leave the greens in the forest in order to retain nutrients on site. Avoid impacts to raptor nests and enhance habitat for diverse prey species. Take proactive steps to avoid the spread of weeds. Avoid and minimize soil disturbance. Retain canopy cover and native ground cover to suppress weeds. Buffer streams from the effects of heavy equipment and loss of bank trees and trees that shade streams. Acknowledge and consider the following potentially significant issues in the NEPA analysis: Removing commercial sized logs, and associated roads and slash disposal, often conflicts with other resource values such as soil, water, weeds, wildlife habitat, fire hazard, and carbon storage. Removal of commercial sized logs can make the stand hotter, dryer, and windier, making fire hazard worse instead of better; Commercial logging tends to present significant risks of weed infestations because of soil disturbance and canopy reduction; Removal of commercial logs necessitates road related impacts on soil and water resources. Machine piling and pile burning tend to cause	Snags and down wood are addressed in Chapter 3. Known nests are protected as well contract clauses that allow protection of discovered nests. Mitigation Measures in Chapter 2 addresses steps to avoid spreading weeds including equipment washing. Riparian Thinning treatments are addressed in Chapters 2 and 3. Table 7 summarizes riparian reserve management

Submitter	Comment	Response and Where Addressed in the EA
	significant adverse impacts on soil and water, especially when combined with road impacts and other logging disturbances. “Capturing mortality” reduces future snag habitat that is already deficient. Increasing vigor via thinning delays recruitment of snag habitat that is already deficient. **<u>Fuels Management Concerns</u>** We are, however, concerned about whether fuels reduction on adjacent private land will be done to make the Forest Service’s efforts more effective. We hope so, as cooperation with local landowners is an important step in ensuring effective fuels reduction. Consider a NEPA alternative that treats only surface and ladder fuels and controls stocking while retaining canopy cover that maintains cool, moist fuels, suppresses future ladder fuels, and provides wildlife habitat. **<u>Water Quality</u>** In general, we usually ask that any commercial harvest activities or road construction in key watersheds or municipal watersheds should be avoided in order to protect water quality. You should minimize impacts to fish habitat and drinking water quality through the project proposal. **<u>Roadless Areas</u>** In general, Oregon Wild asks the agency to avid timber harvest, roads, mining, development and motorized recreation in roadless areas > 1000 acres or any roadless adjacent to existing wilderness or parks and all inventoried roadless areas. We have identified a few small unroaded areas and some roadless extensions to inventoried roadless areas within the project area: Scout Creek area (1300 acres) and additions to the Mount Hagen IRA and McClennan Mountain IRA. (see map below) **<u>NEPA Alternatives</u>** We propose, as noted above in several places, an action alternative that is based on restoration principles and small diameter fuels reduction.	Potential project effects on the spread of Invasive plants is discussed in Chapter 3. Impacts to soil and water resources are discussed in the sedimentation and roads section in Chapter 3. A Community Wildfire Protection Plan is intended to involve community members in “living with fire” as discussed in the Fire and Fuels section of Chapter 3. The non-commercial reduction of ladder fuels of small diameter , <7” dbh material is proposed in Alternatives B and C. These areas are in the Wildlnd Urban interface. This project is not within a key watershed. Significant issue #1 is Water Quality/Aquatic resources and is addressed in chapters 2 and 3. Riparian management is discussed in Chapter 3.

Submitter	Comment	Response and Where Addressed in the EA
	We believe such alternative would still meet the purpose and need while better contributing to overall forest health in the wildland-urban interface.	There are no treatments planned in Inventoried Roadless Areas. Unroaded areas are present the project area and are discussed in Chapters 1 and 3. Effects of activities in unroaded areas are presented on pages 155-157. Considerations were made for a host of potentially significant issues. The significant issues as well as non significant issues are discussed in Chapter 1. Alternative C responds to some of these concerns, removing harvest in stands over 80 years old.

Appendix I

Bridge Thin EA Cumulative Effects

This analysis lists and describes management activities that have occurred in the past within the project area, along with ongoing, and reasonably foreseeable future actions. The effects of these actions below could contribute cumulatively to the effects of the proposed actions in the Bridge Thin Project Area, and are considered in the Bridge Thin Environmental Assessment.

Table 1. Past, Ongoing, and Reasonably Foreseeable Forest Service Actions in the Bridge Thin Project Area.

Actions	Description	Resources Affected
Timber Harvest	**Past:** Acreage of past timber harvests in the Bridge Thin Project Area is presented by decade, and also the post-timber sale silviculture treatments in Table 2. Data was obtained from the Willamette National Forest Vegis Database. Since the 1940's approximately 4,800 acres of timber harvest have occurred on Forest Service lands. Nearly 1,100 acres of this total is pre-commercial thinning. Since 2000 only 260 acres of harvest have occurred on Forest Service lands in the project area, with no regeneration harvests and 224 acres of pre-commercial thinning. **Ongoing/Reasonably Foreseeable:** Pre-commercial thinning and pruning may occur on some stands in the project area. No ongoing or reasonably foreseeable timber sale projects are located in the project area.	Vegetation, Soil & Water, Fisheries, Roads & Access Mgmt, Invasive Plants
Road Maintenance	**Past:** There are 61.5 miles of Forest system roads in the project area, and approximately 21 miles have been closed with either gates, berms, or other structures in the past. Road maintenance work includes activities to reduce brush, clean out drainages, and repair road surfaces on many of the key and secondary roads in the project area (Willamette Roads Analysis, 2003) **Ongoing/Reasonably Foreseeable:** The Forest system roads receive annual maintenance in accordance with established road management objectives.	Soil & Water, Fisheries, Roads & Access Mgmt, Invasive Plants
Travel Management EA (Expected to be Implemented 12/2009)	**Reasonably Foreseeable:** To comply with Final Travel Mgmt Rule [FR, Vol 70, No. 216 (2005)] for motorized access a Travel Management EA is planned. The Travel Management Rule requires the designation of National Forest System roads & trails open to motor vehicle use (including OHV use) by vehicle class and, if appropriate, by time of year.	Soil & Water, Fisheries, Roads & Access Mgmt , Invasive Plants
Trails and Developed Recreation site maintenance	**Past:** Existing trails in the project area include the King Castle and Delta Old Growth Trails, which are located along the east boundary of the project area. Existing developed recreation facilities constructed within the project area include Delta campground, Forest Glen Boat Landing, Hamlin Boat Landing, and McMullins	Soil & Water, Fisheries, Recreation

Actions	Description	Resources Affected
	Boat Landing. **<u>Ongoing/Reasonably Foreseeable:</u>** Trail maintenance to keep the King Castle and Delta Old Growth Trails clear of logs and slides occurs annually. Normal facility maintenance activities occur annually at all developed recreation sites, including those listed above.	

Table 2. Acres of Past Timber Harvest in the Bridge Thin Project Area.

Decade	Historic Management on Federal Land; Acres by Activity Category				Total
	Regeneration Harvest	*Commercial Thinning*	*Salvage*	*Pre-commercial Thinning*	
1940s	710	0	0	0	710
1950s	69	0	0	0	69
1960s	664	0	0	0	664
1970s	395	18	34	267	714
1980s	478	249	28	284	1039
1990s	532	282	216	312	1342
2000-Present	0	21	15	224	260
Total	2,848	570	293	1,087	4,798

Table 3. Past, Ongoing, and Reasonably Foreseeable Non-Forest Service Actions in the Bridge Thin Project Area.

Non-Forest Service Actions	Description	Resources Affected
Timber harvest	**<u>Past:</u>** There is no reliable source of vegetative age data for private industrial forest lands in the project area, but based on GIS analysis and knowledge of the area, it is estimated that approximately 75%, or 6,400 acres, of the private lands in the project area are industrial forest lands. There is no record of past harvest amounts, but it is reasonable to infer that private industrial forest lands have been managed on a 40-50 year rotation. Consequently, past regeneration timber harvest has likely occurred on the 6,400 acres of industrial forest lands in the project area since the 1940's. **<u>Ongoing/Reasonably Foreseeable:</u>** Management of these industrial forest lands are not anticipated to change in the reasonably foreseeable future.	Vegetation, Soil & Water, Fisheries, Wildlife, Invasive Plants

Non-Forest Service Actions	Description	Resources Affected
Road construction, maintenance and use	**Past:** Currently there is 22.7 miles of private roads and driveways. Lane County maintains 6.3 miles of county roads in the project area. The BLM maintains 12.7 miles of road in the project area. **Ongoing/Reasonably Foreseeable:** Road construction and maintenance by private landowners on private lands will continue and potentially increase with more residential development. It is assumed that maintenance on Lane County and BLM roads will continue to occur as needed.	Soil & Water, Fisheries, Roads & Access Mgmt, Invasive Plants
Rural-residential development of private land	**Past:** Based on GIS analysis there are over 300 structures located on private land in the project area. The community of Blue River is located in the western portion of the project area. Development is focused along both sides of State Hwy 126 and the McKenzie River, and includes residential structures, businesses, and a golf course. **Ongoing/Reasonably Foreseeable:** Trends indicate the potential for increased residential development on private lands in the project area. Approximately 25%, or 2,300 acres, of the private lands in the project area are considered to be non-industrial forest lands, and likely to experience at least low-to-moderate amounts of development.	Soil & Water, Fisheries, Wildlife, Roads & Access Mgmt
Powerline Corridor Construction/Maintenace	**Past:** There are 11.6 miles of powerline corridor in the project area, maintained by BPA and EWEB. **Ongoing/Reasonably Foreseeable:** Existing powerline corridors will be maintained by EWEB and BPA	Invasive Plants, Roads& Access Mgmt